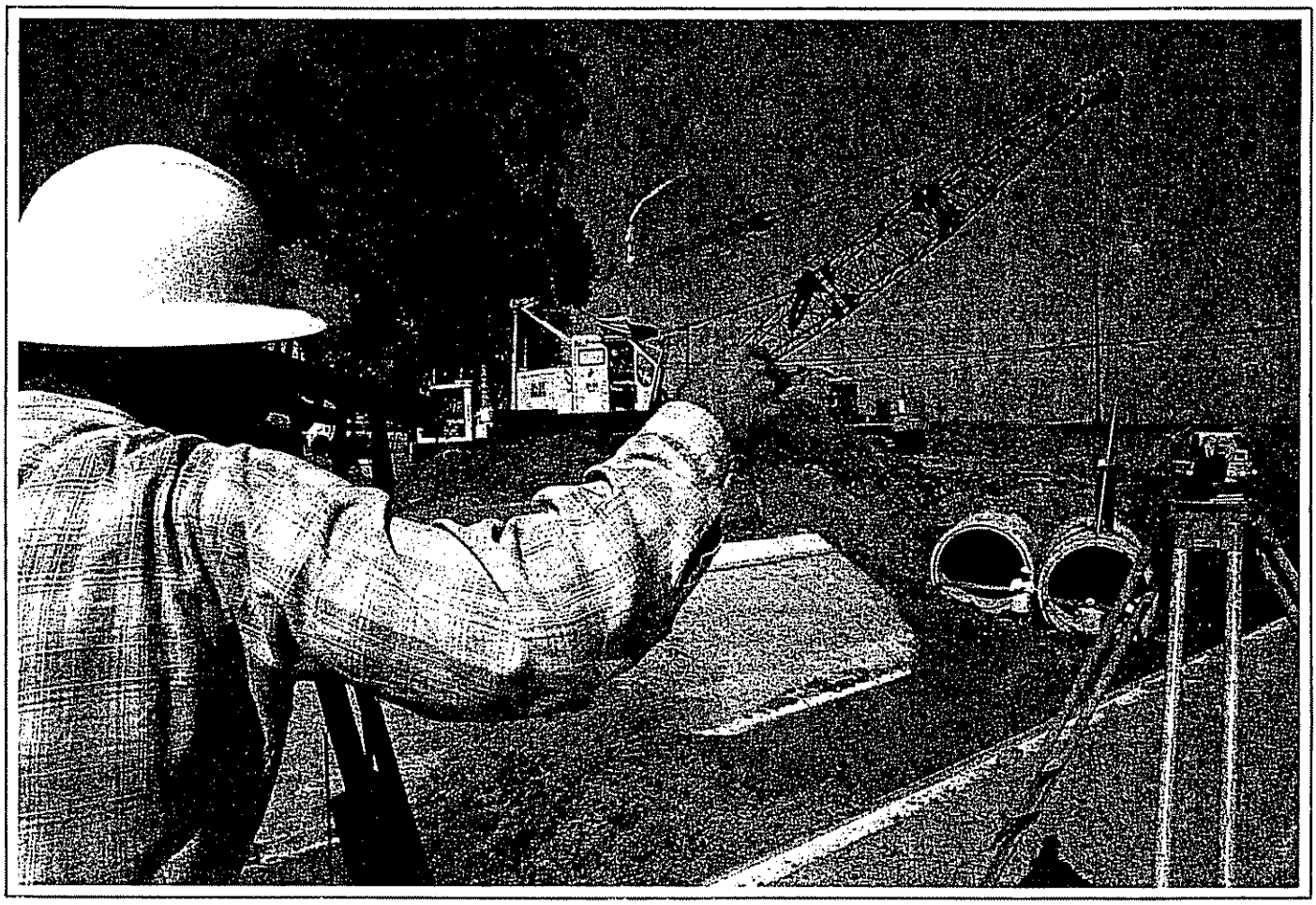
5-1

WATER CONSERVATION ACTIVITIES

1987



IMPERIAL IRRIGATION DISTRICT

IMPERIAL IRRIGATION DISTRICT

1987

WATER CONSERVATION ACTIVITIES

PREFACE

Imperial Irrigation District prepared a Water Conservation Plan in 1985 and an Update of that Plan in June 1986. The purpose of this Activities Report is to state the conservation activities carried out during 1987. This report is broken down into Administration Activities, Planning Activities and Water Conservation Programs.

EXECUTIVE SUMMARY

Imperial Irrigation District's (IID) water conservation activities for 1987 consisted of a variety of programs as proposed in the 1985 Water Conservation Plan; specifically Chapter VI - Water Conservation (Plan). In developing its water conservation program from the Plan, IID is taking a comprehensive approach. Once general policy is adopted, programs are evaluated for effectiveness. Where feasible, programs are then implemented in the field.

Three areas can be outlined that would aid in understanding the IID's approach to water conservation:

1) Administrative actions,
2) Planning activities,
3) Water conservation programs.

ADMINISTRATIVE ACTIONS

The IID Board of Directors (Board) has adopted a water conservation general policy that provides a comprehensive approach to it's strengthening commitment to water conservation and water marketing. Included on the Board's agenda was additional support for public education activities both locally and statewide.

Water transfer policy has also been adopted by the Board which will enable interested parties to use IID's conserved water based on 12 "Principles

of Water Negotiations." These are based on negotiations that have been conducted with the Metropolitan Water District.

Subsequent to this action the Board initiated a sale of conserved water to I.T. Corporation under the umbrella of Section 1011 of the California Water Code. After discussions with the State Treasurer's Office, the Department of Interior, Metropolitan Water District, Coachella Valley Water District and Palo Verde Irrigation District, IID finalized the sale.

The IID Board received recommendations from the Water Conservation Advisory Board throughout the year concerning on-farm practices. As a result of this, the Board adopted a comprehensive 15-Point Program, to supersede the 21-Point Program previously in effect.

PLANNING ACTIVITIES

Several programs and studies were approved by the Board as proposed in the 1985 Water Conservation Plan. Water conservation awareness by field operations personnel was also stressed throughout the year. Section 2 describes specific pilot projects and studies being evaluated for possible field implementation.

Trial Programs

Two new field-operation trials were completed in 1987. A 45-day 12-hour-delivery trial was conducted in the Holtville Water Division to determine:

1) Water conserved,

2) Cost incurred,

3) Problems encountered by implementing the program, since normal deliveries run in 24-hour periods,

4) Acceptability of the program by water users.

Results were mixed, but overall the trial conserved a significant amount of water.

A second trial involved a weekend water rate reduction to encourage more evenly distributed water orders.

A 10 percent rate reduction ($1/AF) was provided as an incentive to water users to order water on the weekends. The trial program did not result in more water orders for weekends, but did indicate that a $1/AF incentive is probably not enough to change water user practices.

Water Conservation Studies

Several special studies were conducted by the IID to identify water conservation alternatives. Underground storage and recovery of Colorado River surplus water within the East Mesa area is under investigation in conjuction with USBR. IID is looking at the possible use of aquifers on the west side of Imperial Valley for the same purpose.

IID and the U.S. Water Conservation Laboratory of Phoenix, Arizona continue to jointly study the causes and effects of water level fluctuations in laterals. A technical paper entitled "Investigation of Main Supply Canal and

Lateral Fluctuations," was prepared by IID staff for the 1987 ASCE Specialty Conference on Irrigation Systems for the 21st Century. (Exhibit 5).

Seepage from the East Highline Canal is being quantified through a joint study being conducted by USBR and IID. This is part of USBR's Concrete Lining and System Improvement Study to in part determine the feasibility of lining the East Highline Canal.

Implementation Plan

An Implementation Plan has been developed to outline the implementation strategy, schedules, project descriptions and cost data necessary of an expanded water conservation program. All proposed water conservation projects are included.

In order to accelerate placement of high yield water conservation projects included in the Implementation Plan, the IID has submitted funding applications under the Clean Water Bond Law of 1984 and the Water Conservation and Water Quality Act of 1986. Seven projects were submitted:

1) Trifolium Extension Reservoir has been approved and is presently under construction,

2) Concrete lining two miles of the South Alamo Canal is pending final approval,

3) A lateral interceptor canal and storage reservoir has been tentatively approved,

4) Concrete lining the remaining 3.2 miles of the South Alamo Canal,

5) Concrete lining 2.4 miles of the Acacia Canal,

6) Construction of "Z" Lateral Reservoir,

7) Installation of a pumping station at the Sperber Reservoir.

Salton Sea Studies

Part of the Water Conservation Program requires mitigating negative impacts to the Salton Sea. A computer model has been developed by the IID staff to simulate elevation and salinity changes under various hydrologic conditions and pumping schemes. Two projects are being considered to study the effect of evaporation ponds outside the Salton Sea's perimeter to reduce salinity. The Salton Sea Task Force, chartered by Governor Deukmejian and actively supported by IID, was formed to identify and resolve environmental problems.

WATER CONSERVATION PROGRAMS

Several water conservation programs were adopted in 1987 as part of the IID's operating routine. Progress was made in the tailwater, regulating reservoirs, system automation, operational discharge, tile drain discharge, seepage recover, hydrilla control and on-farm programs.

Tail Water Monitoring

The tailwater monitoring program was revised and IID personnel checked 91.7 percent of the deliveries over 1 cfs. Deliveries of 1 cfs or less are normally for stock water and residential use and very seldom have any tailwater.

Regulating Reservoir

IID also commenced construction of a fifth regulating reservoir, Trifolium Extension Canal Reservoir. Strategically located at the end of the Westside Main Canal, it is estimated that 4,600 AF of water will be conserved by this facility. Full operation is to begin by September, 1988. All controls will be accomplished by an intelligent field unit, with supervisory control being exercised from the Water Control Center.

Operational Discharge

The IID monitored operational discharge and recorded an estimated 94,157 AF of spill for 1987. This compares with the 1986 estimate of 96,110 AF.

Tile Drain Discharge

Monitoring for tile drain discharge was conducted over a sample set of drain outlets. The program is currently being re-evaluated for accuracy.

Seepage Recovery

One of the highest yielding programs in operation was the seepage recovery program. Twelve seepage recovery systems along the East Highline Canal conserved 16,067 AF of water making this one of the highest yielding programs being operated. Seepage recovery along the All-American Canal recovered approximately 8,000 AF of water.

Hydrilla Control

The Hydrilla Control Research Program, which indirectly aids water con-

servation activities, has identified the Triploid Grass Carp as being excellent for eliminating hydrilla from waterways. IID is currently constructing a grass carp production facility which will be used to supply this fish for local use.

Demonstration Tailwater Recovery

A continuing program for operation of tailwater recovery systems was streamlined at five locations. The recovery systems allowed these users to operate with efficiencies of 87 to 99 percent. Extensive data has been gathered and analyzed to review salinity and temperature increases in recovered water.

Irrigation Scheduling/CIMIS

IID also continued to provide on-farm irrigation technical support through the Irrigation Scheduling and CIMIS Programs. CIMIS evapotranspiration data is now being used to model soil moisture depletion in the Irrigation Scheduling Program. Thirty-three growers cooperated in the program. The average irrigation efficiency for 1,199 irrigations monitored in 1987 was 85 percent.

SUMMARY

An overview of the effects IID water conservation practices have made on total diversions from the Colorado River can be made. The average annual diversion from 1960 to 1970 are 170,935 AF greater than diversions from 1977 to 1987. The general down trend in IID diversions can be appreciated graphi-

cally by referring to Exhibit 8. This drop is comparable to estimates of water conserved annually by various programs instituted by the IID:

Concrete Lining	57,000 AF
Operational Discharge Reduction	26,000 AF
Seepage Recovery	25,000 AF
Tailwater Assessment	20,000 AF
TOTAL.....	138,000 AF[1/]

A decrease has also been noted in IID's portion of inflow to the Salton Sea within the last ten years (Exhibit 9). After adoption of the 21-Point Program in 1980, a 5.7 percent reduction has occurred; this equates to 189,000 AF annually.

1/ Parsons, 1985.

LIST OF TABLES

LIST OF EXHIBITS

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS

1.0 ADMINISTRATIVE ACTIVITIES

1.1 Introduction

If there was one issue that occupied the time and efforts of the Imperial Irrigation District (IID) during 1987, it was Water Conservation. This subject took many forms from Policy and Study to Projects and Operations Management. Activities covered the spectrum from revising the rules governing tailwater to negotiating for funds for the conservation plan. Numerous hours were spent deliberating, meeting, and directing water conservation activities.

1.2 Board of Directors

The IID Board of Directors confirmed its continuing commitment to the Southern California water education effort by approving the Southern California Water Policy Paper. This policy, currently in circulation to all of Southern California, calls for conservation as a key part of any future statewide water plan.

The IID also participated in the statewide Water Awareness Campaign by contributing to the Department of Water Resources program. Locally, several events were scheduled to make Imperial Valley more water-aware.

Another of the Board's continuing efforts was support for the National Association of Conservation Districts by providing office space, paying dues and serving as the Board for the local Resource

Conservation District. In that capacity, the Board approved several applications for conservation projects including tiling for salinity control. The IID also hosted the Area VIII Regional Meeting in October.

In other actions, the Board made a proposal to the USBR regarding the use of 28,000 AF of conserved water annually for replacement of the reject stream flow from the Yuma Desalting Plant. The USBR has not yet responded to the offer.

The Board agreed with the International Boundary and Water Commission's Finding of No Significant Impact for the "International Agreement For Joint Project For Improvement of the Quality of the Waters of the New River." The primary goal of this proposed project is to improve the quality of water discharging into the Salton Sea.

In January of 1987 the Board initiated actions to develop a Water Transfer Policy before negotiations with Metropolitan Water District were resumed. Public meetings were held with county groups including the County Board of Supervisors and the Farm Bureau regarding a Water Transfer Policy. By mid-April, 12 "Principles of Water Negotiations" were approved:

1. Recognition of Imperial Valley's water rights.

2. Agree that Imperial Valley has the right to the water which is required to meet the Valley's needs.

3. The acquiring agency shall pay fair market value for all water made available by the District. The initial agreement shall be based on 100,000 AF of water that has been conserved by the District. No additional water will be available until it has been conserved.

4. Any payment will escalate based on the increase of the price of water sold by the acquiring agency to others.

5. Term of the agreement shall be for 25 years with a 15-year cancellation clause. The parties shall also have the right to renew or renegotiate the agreement after each 10-year period.

6. The transferee will agree to help the District seek legislative and financial aid in solving the New River, Salton Sea and other environmental concerns.

7. The District agrees to investigate the possibility of making more water available during a drought by compensating the farmers for conserving water. The maximum amount of water available through this program shall not exceed 200,000 AF. However, this water shall not be available more often than one out of every four years.

8. Allowable use of payments received for conserved water must be beneficial to the whole Valley and must be identified in the water conservation agreement.

9. The maximum amount of water available for use by others shall not exceed 250,000 AF per year.

10. The agreement shall include provisions for mitigating environmental concerns.

11. Any agreement must be approved by the voters residing within the District's boundaries.

12. The agreement must be approved and validated by an appropriate court.

The Board initiated an action to sell conserved water outside the District boundaries to the I.T. Corporation which met some resistance. After protracted discussions with the State Treasurer's Office, the Department of Interior, Metropolitan Water District, Coachella Valley Water District and Palo Verde Irrigation District, the IID was able to sell 100 AF of conserved water for $250/AF.

Following many weeks of discussion, the Board on October 27, 1987 adopted Resolution No. 32-87, (Exhibit 1) regarding the concept of marketing conserved water under Section 1011 of the State Water Code.

At the final meeting of 1987 the Board endorsed the concept of a Water Marketing Association. In conjunction with the push for the Water Marketing concept and theory, several consultants and attorneys were retained to promote and develop this principle to its

fullest extent in California. These activities by the Board placed the District in the forefront of a new era of water management in the West.

1.3 Water Conservation Advisory Board

The Board's Water Conservation Advisory Board (WCAB) has continued to be active. Three new members were appointed to the Water Conservation Advisory Board by the IID Board of Directors in 1987.

The WCAB made many recommendations during the year regarding tailwater rules, grower incentives and operational practices.

RESOLUTION NO. 32-87

WHEREAS, Southern California urgently needs new sources of water to meet the growing water needs of coastal metropolitan areas, and

WHEREAS, the two major sources of additional water are from water conservation and an orderly transfer of water from areas of abundance to areas of need, and

WHEREAS, State law allows for the transfer of conserved water while protecting the water rights of the areas of origin, and

WHEREAS, realistic incentives to encourage voluntary water conservation and to encourage the voluntary transfer of water from areas of abundance to areas of need are lacking;

NOW, THEREFORE, on motion of Director Bornt, seconded by Director Condit, BE IT HEREBY RESOLVED, that the Board of Directors of the Imperial Irrigation District, having successfully pioneered water conservation techniques in the largest irrigation district in the country, and having negotiated in good faith to transfer the conserved water to another water agency in need of additional water resources, unanimously endorses the principle of marketing water, following the free enterprise principles of the market place, as the most practical and effective way to provide needed incentives for water conservation and the voluntary transfer of water from areas of abundance to areas of need.

PASSED AND ADOPTED this 27th day of October, 1987.

IMPERIAL IRRIGATION DISTRICT

By _____
President

By _____
Secretary

IMPERIAL IRRIGATION DISTRICT ORGANIZED JULY 25, 1911 EL CENTRO, CALIFORNIA

Copies:
Shreves
Legal
Wheeler
Hull
General Files

EXHIBIT 1

2.0 PLANNING ACTIVITIES

2.1 Introduction

Because the success of the water conservation program is dependent on implementation in the field, increased awareness by the operations staff was a main goal of management during 1987.

As programs are developed by office staff and adopted as part of the IID's operations, field personnel have been trained to incorporate them into their daily routine. Attention has focused on:

1) A more intensive scrutiny of tailwater, with a goal of checking 100 percent of all orders of 1 cfs and above.

2) Insuring that gates are properly sealed.

3) Providing flexibility where possible to allow water to be moved from the original delivery gate.

This section describes specific pilot projects or studies being evaluated for possible field implementation.

2.2 Water Measurement

Water measurement is a critical part of the IID's water conservation program. The IID utilizes various methods for measuring water, including water measurement through an orifice structure (delivery gate), over rectangular and broadcrested trapezoidal weirs, and current metering.

The electronic age has opened new horizons in water management. In the past few years the IID has purchased electronic dataloggers for use in conjuction with weirs to quantify water deliv-eries and tailwater in several of the IID's conservation programs.

An ultrasonic flow meter was purchased in 1987 to measure water where there is not enough available head for orifice or weir structures. The ultrasonic recorder is now being considered for use in selected locations in the main canals and the New River and Alamo River.

2.3 Weekend Water Rate Reduction

Water orders for the weekend have slowly declined over the years, and have apparently reached a stable level at this time. Decreased ordering on weekends is due to farmers' and their irrigators' reluctance to irrigate on weekends.

In general, orders for water are low on Sunday and increase steadily during the week. They reach a peak on Wednesday and Thursday, decline moderately on Friday and Saturday, and then plunge an average of 24 percent on Sunday. The cycle is then repeated each week.

To provide an incentive to farmers to order more water on the weekends a reduced water rate pilot program was instituted by the

Board on September 1, 1987. The water rate on Saturdays and Sundays was reduced from $10/AF to $9/AF. The trial ran through December 31, 1987. Exhibit 2 is a chart covering water deliveries in September, October and November 1986 and 1987. In 1986 water delivered on Saturdays during the three month period dropped an average of 5.7 percent from the high of the week. On Sunday it dropped an average of 20.1 percent. In 1987 during the trial on Saturdays and Sundays, the water delivered dropped 6.2 percent and 19.3 percent respectively.

It became apparent that reducing the water rate by $1/AF was not enough incentive to irrigate on weekends. Although the trial did not result in additional water being ordered on weekends, it did supply information indicating that an incentive of $1/AF for other types of projects would probably not result in any change in farmer practices.

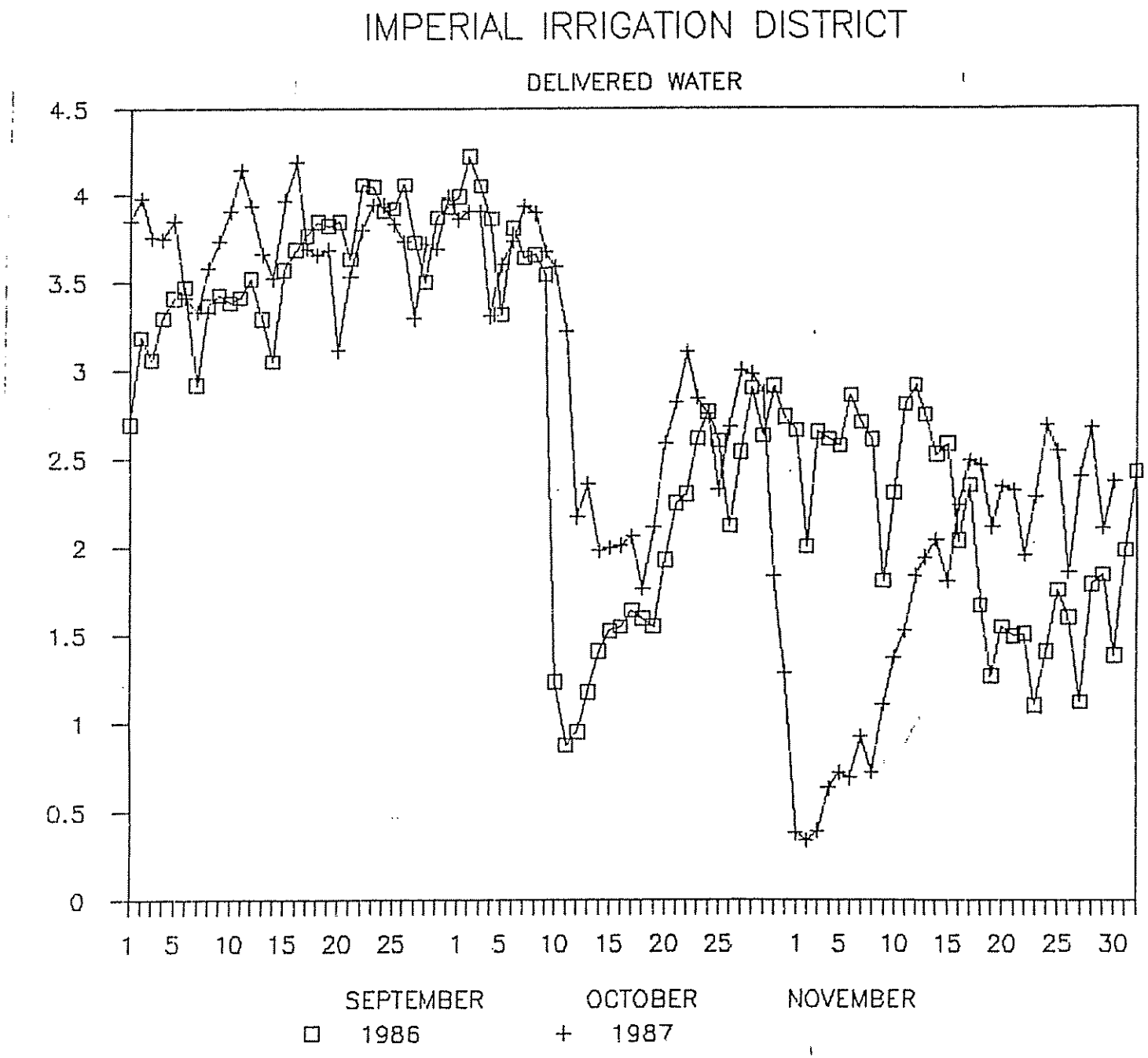

IMPERIAL IRRIGATION DISTRICT
DELIVERED WATER
DELIVERED CFS
(Thousands)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1 5 10 15 20 25 1 5 10 15 20 25 1 5 10 15 20 25 30
SEPTEMBER
OCTOBER
NOVEMBER
1986
1987

EXHIBIT 2

2.4 Twelve Hour Delivery Trial

Twelve hour delivery for seed germination was an option recommended by the WCAB to conserve water.

The IID delivers water in 24-hour segments, which can cause problems during sprinkler germination of crops. Sprinkling is done during the day to keep the soil moist and the young seedling cool. Continuing to sprinkle during the night will result in puddling, oxygen depletion, excessive run-off and plant mortality. If water delivery is made available in 12 hour periods, the potential exists to conserve water.

Beginning on October 9, 1986, a 45-day, 12-hour delivery trial was conducted in the Holtville Water Division. The purpose of the trial program was to determine the following:

1) Water conserved,
2) Cost incurred,
3) Problems encountered by implementing the program,
4) Acceptability of program by water users.

Records were kept on each 12-hour delivery that was requested. There were no recorders installed to quantify water savings due to time constraints. A summary of the 180 12-hour deliveries that were made is contained in Exhibit 3. District staff has estimated the amount of water that was conserved. Below are the assumptions and conclusion developed.

HOLTVILLE DIVISION – 12-HOUR RUN FOR STAND ESTABLISHMENT REPORT

Date	Canal	Gate	Name	Order CFS	Crop	Order Start A.M.	Order Start P.M.	Hrs. Run	Vehicle Miles	Man Hrs.	O.T. +Hrs.	CFS Moved	CFS Removed *	Canal Discharge A.M.	Canal Discharge P.M.	Gates Adjusted	Q @ Hdg. CFS	Irrigation Sprinkle	Irrigation Row	Comments
10-09-86	Pear	11	Brady	4	Carrots	7:00	-	10	10	2	+ 3	-	4 (2)	-	-	-	80	x	-	Frequent request for 12-hrs emergency water.
10-09-86	Peach	3	Brady	3	Lettuce	7:10	-	10	20	1	+ 1	-	3 (2)	-	-	-	3	x	-	
10-09-86	Ash Lat. 15	102	Claverie	3	Carrots	7:30	-	12	10	1	+ -	-	3 (1)	-	-	6	44	x	-	
10-10-86	So. Alamo	17-A	Brady	3.5	Carrots	6:30	-	12	15	2	+ -	-	3.5 (2)	-	-	4	35	x	-	Frequent request to hold water for 2 or more hours before starting to irrigate
10-10-86	Holt	82	Bornt	1	Celery	refused-rain		-	-	-	-	-	1 (2)	-	-	-	-	-	-	
10-10-86	ElL Lat. 1	138	Bornt	1.5	Lettuce	refused-rain		-	-	-	-	-	1.5 (2)	-	-	-	-			
10-12-86	Holt	82	Bornt	1	Celery	7:00	-	12	25	2	+ -	-	1 (2)	-	-	2	16	x	-	
10-12-86	So. Alamo	81	Vessey	1.5	Lettuce	8:30	-	12	15	2	+ -	1.5	-	-	-	4	40	x	-	Stored in gate 31 pond
10-12-86	So. Alamo	79	Vessey	1	Lettuce	8:30	-	12	15	2	+ -	1	-	-	-	4	40	x	-	Stored in gate 31 pond
10-13-86	Hemlock	34	Grizzle	4	Lettuce	7:30	-	12	15	2	+ -	-	4 (2)	-	-	4	22	x	-	
10-13-86	Pomelo	6	Pfister	2.5	Broccoli	8:05	-	12	20	2	+ -	-	2.5 (2)	-	-	1	23	x		
10-14-86	Pomelo	6	Pfister	1.5	Broccoli	7:20	-	12	45	1	+ 1	-	2 (2)	-	-	2	21	x	-	Gt. 31 requested water, then refused @ 7:15 p.m.
10-14-86	Pear	11	Brady	3	Carrots	6:10	-	12	20	1	+ 1		3 (2)	-	-	4	39	x	-	
10-15-86	Pear	53-C	Nilson	1.5	Broccoli	9:00	-	12	30	3.5	+ 3.5	-	1.5 (2)	-	-	7	44	x	-	
10-15-86	Ash	159	Hagco	4.5	Carrots	7:45	-	9	20	1	+ 2.5	-	4.5 (1)	6 cfs	2 cfs	2	25	x	-	Gate closed @ 5:00 p.m.
10-15-86	Mesa Lat. 3	42	Strahm Farms	4.5	Carrots	7:50	-	12	32	1	+ 1	-	4.5 (2)	-	1 cfs	3	13	x	-	
10-16-86	Ash Main	44	Fornasero	1.5	Lettuce	7:30	-	12	15	.5	+ 2.5	-	2 (2)	2 cfs	1 cfs	3	63	x		
10-16-86	Ash Lat. 15	104	Hagco	4.5	Carrots/ Lettuce	7:00	-	12	30	2	+ 3.5	-	4.5 (1)	3 cfs	3 cfs	2	20	x	-	Water ran to 3 gates during run then to reservoir
10-16-86	So. Alamo	17-A	Brady	3.5	Carrots	6:50	-	12	23	.5	+ 1.5	-	4 (2)	-	-	4	38	x	-	
10-16-86	ElL Lat. 11	268	Marini	3.5	Carrots	7:00	-	12	30	2	+ 2	-	4 (2)	-	-	-	4	x		
10-16-86	Pine	33	Hawk	3	Lettuce	8:00	-	12	10	1.5	+ 2	-	3 (2)	1.4 cfs	-	-	4	x		
10-16-86	Orient	20	Saikhon	3	Carrots	8:20	-	12	46	1	+ 2	3	-	-	-	-	18	x	-	Req. to run on gt. 22 for last 12 hours

*Legend:
1 = Water went to Reservoir
2 = Water went to Main Canal
3 = Water went to Lateral Canal
4 = Water wentt to Spill

12-HOUR.1A

12-HOUR RUN DATA - OCTOBER 8 THRU NOVEMBER 21

Date	Canal	Gate	Name	Order CFS	Crop	Order A.M.	Start P.M.	Hrs. Run	Vehicle Miles	Man Hrs. +	O.T. Hrs.	CFS Moved	CFS Removed	Canal Discharge A.M.	Canal Discharge P.M.	Gates Changed	Q @ Hdg. CFS	Irrigation Sprinkle	Irrigation Row	Comments
10-17-86	Ash	160	Hagco	4.5	Lettuce	-	6:00	12	5	1.5	+ -	-	- *	5 cfs	4 cfs	4	13	x	-	4.5' open order started in A.H.
10-17-86	Peach	3	Brady	3	Lettuce	6:30	-	12	17	1	+ 2	-	4 (2)	-	-	-	4	x	x	
10-17-86	So. Alamo	17-B	Brady	3	Carrots	6:45	-	12	24	.5	+ 2	-	3 (2)	-	-	6	69	x	-	
10-17-86	Orient	29-A	Herten	2.5	Sug.beets	9:15	-	12	53	1	+ 4	-	3 (2)	2 cfs	-	3	25	x	-	
10-17-86	Ash	212	Pemberton	3	Lettuce	9:30	-	12	15	1.5	+ -	3 (3)	-	7 cfs	5 cfs	-	10	x	-	moved to gt. for P.H., gt. 12, used for canal discharge
10-18-86	So. Alamo	17-A	Brady	3	Carrots	6:45	-	12	25	.5	+ 2	-	3 (2)	-	-	6	55	x	-	
10-18-86	EHL Lat. 11	268	Marini	4.5	Carrots	7:30	-	11	15	1	+ 2	-	5 (2)	-	-	-	12	x	-	
10-18-86	Peach	3	Brady	3	Lettuce	7:30	-	11	15	1	+ 1	-	3 (2)	-	-	-	4	x	-	
10-19-86	Ash	159	Hagco	2.5	Carrots	8:10	-	12	13	.5	+ 1.5	-	2.5 (1)	8 cfs	5 cfs	2	14	x	-	
10-19-86	Ash	101	Hagco	2	Lettuce	6:45	-	12	13	.5	+ 1.5	-	2 (1)	8 cfs	5 cfs	2	14	x	-	
10-19-86	Peach	3	Brady	3	Lettuce	7:00	-	11	19	1	+ 2	-	3 (2)	-	-	-	20	x	-	
10-19-86	So. Alamo	17-B	Brady	3	Carrots	6:40	-	12	24	.5	+ 1.5	-	- (3)	-	-	4	94	x	-	Water used for ponds
10-20-86	EHL Lat. 8	225	Strahm & Sons	1.5	Broccoli	7:15	-	12	27	1	+ 2	-	2 (2)	-	-	2	8	x	-	
10-20-86	Ash	104	Hagco	3	Carrots	7:10	-	12	28	1	+ 2	-	3 (1)	8 cfs	-	3	14	x	-	
10-20-86	EHL Lat. 1	138A	Brady	3	Lettuce	7:30	-	12	26	1.5	+ 2	-	3 (2)	-	-	3	33	x	-	
10-20-86	Hemlock	21	Strahm & Sons	2.5	Lettuce	8:00	-	12	28	1	+ 2	-	3 (2)	-	-	4	6	x	-	
10-21-86	EHL Lat. 14	305	Grizzle	3	Lettuce	7:00	-	11	19	1	+ 2	-	3 (2)	-	-	1	10	x		
10-21-86	EHL Lat. 8	225	Strahm & Sons	1.5	Broccoli	7:05	-	12	26	1	+ 2	-	2 (2)	1 cfs	.5 cfs	2	19	x		
10-21-86	Orient	29-A	Herten	2.5	Sug.beets	10:30	-	12	30	1	+ 2	-	3 (2)	-	-	3	15	-	x	
10-22-86	Ash	102	Claverie	2.5	Carrots	7:10	-	12	30	1	+ 2	-	2.5 (2)	2 cfs	3 cfs	4	24	x	-	
10-22-86	Peach	2	Brady	3.5	Carrots	7:10	-	11	20	1	+ 1	-	3.5 (2)	-	-	-	16	x	-	
10-22-86	Holt	84	Bornt	1.5	Onions	7:15	-	12	26	.5	+ 1	-	1.5 (2)	-	-	-	20	-	x	
10-23-86	So. Alamo	15-A	Henvielle	1.5	Broccoli	6:45	-	12	18	.5	+ 1.5	-	- (3)	-	-	3	66	x	-	Water used for canals oper.
10-23-86	Peach	2	Brady	3.5	Carrots	7:00	-	12	12	1	+ 1	-	3 (2)	-	.7 cfs	-	13	x	-	
10-23-86	EHL Lat. 14	305	Grizzle	3	Lettuce	7:30	-	12	11	1	+ 1	-	3 (2)	-	-	1	19	x	-	
10-23-86	EHL Lat. 10	258B	Strahm & Sons	4.5	Carrots	7:30	-	12	27	2.5	+ 2.5	-	4.5 (2)	-	-	3	22	x	-	
10-23-86	So. Alamo	106A	Abatti Produce	2	Carrots	8:30	-	12	13	.5	+ 1.5	-	- (3)	-	-	6	66	x	-	Water used for canal oper.
10-24-86	Pine	9	Luette	4.5	Cauliflr	6:50	-	12	24	2	+ 2	-	4.5 (2)	-	-	1	14	-	x	
10-24-86	Ont	4	Fifield	2.5	Lettuce	7:00	-	12	24	1	+ 1	-	2.5 (2)	-	-	2	4	x	-	
10-24-86	EHL Lat 10	258D	Strahm	4.5	Carrots	7:30	-	12	22	2.5	+ 2.5	-	4.5 (2)	.5 cfs	.5 cfs	2	5	x	-	
10-25-86	EHL Lat. 11	268	Marini	3	Carrots	7:00	-	12	19	1	+ 1	-	3 (2)	.5 cfs	2.7 cfs	1	11	x	-	Gt. closed -2.7 cfs spill
10-25-86	EHL Lat. 10	258D	Strahm & Sons	2.5	Carrots	7:35	-	12	20	2.5	+ 2.5	-	2.5 (2)	-	-	2	3	x	-	
10-25-86	Ash	44	Fornesero	4.5	Lettuce	7:30	-	12	26	2	+ 2.5	4.5	-	2 cfs	-	7	120	-	x	Moved to gate 58 FH/P.H.
10-25-86	Mesa Ant. 3	84	Strahm & Sons	1.5	Lettuce	7:30	-	11.5	33	1	+ 2.5	-	1.5 (2)	.5 cfs	-	4	32	x	-	
10-25-86	Pine	33	Schaffner	3	Lettuce	9:30	-	12	28	1	+ 4.5	-	3 (2)	-	-	2	21	x	-	
10-26-86	EHL Lat. 8	225	Strahm & Sons	1.5	Broccoli	7:45	-	12	22	2.5	+ 2.5	1.5	-	-	-	3	7	x	-	
10-26-86	Ash	102	Claverie	2.5	Carrots	6:40	-	12	31	1	+ 2	-	2.5 (1)	3 cfs	5.4 cfs	8	47	x	-	moved to gate 216, P.H.
10-26-86	Mesa Ant. 5	65	Strahm Farms	4.5	Carrots	7:05	-	12	30	2	+ -	-	4.5 (2)	-	-	-	4.5	x	-	
10-26-86	Mesa Ant. 3	84	Strahm & Sons	1.5	Lettuce	7:30	-	12	25	1	+ 2	-	1.5 (2)	-	-	4	21	x	-	Patrolman found gt. closed

12-HOUR RUN DATA - OCTOBER 8 THRU NOVEMBER 21

Date	Canal	Gate	Name	Order CFS	Crop	Order A.M.	Start P.M.	Hrs. Run	Vehicle Miles	Man Hrs.+ O.T. Hrs.	CFS Moved	CFS Removed	Canal Discharge A.M. CFS	Canal Discharge P.M. CFS	Gates Changed	Q @ Hdg. CFS	Irrigation Sprinkle	Irrigation Row	Comments
10-27-86	EHL Lat 8	216	Nakasawa	2.5	Lettuce	6:20	-	12	10	.5 + .5	-	2.5 (2)	-	-	-	4	x	-	
10-27-86	EHL Lat 8	225	Strahm & Sons	1.5	Broccoli	7:45	-	12	10	1 + 1.5	-	1.5 (2)	-	-	-	4	x	-	
10-27-86	Peach	2	Brady	4	Carrots	7:00	-	11	10	1 + 1	-	4 (2)	-	-	-	16	x	-	
10-27-86	EHL Lat 14	305	Grizzle	3	Lettuce	7:00	-	11	10	1 + 1	-	3 (2)	-	-	-	3	x	-	
10-27-86	EHL Lat. 10	250D	Strahm & Sons	4.5	Carrots	8:00	-	12	20	1.5 + 1.5	-	4.5 (2)	-	-	-	5	x	-	
10-27-86	Mesa Lat. 4	54	Holdridge	1.5	Carrots	6:30	-	12	25	1.5 + -	-	1.5 (2)	-	-	-	1.5	x	-	
10-27-86	Mesa La 5	65	Strahm Farms	4.5	Carrots	7:00	-	12	15	1.5 + -	-	4.5 (2)	-	-	-	4.5	x	-	
10-28-86	Peach	2	Brady	4	Lettuce	7:00	-	11	12	1 + 1	-	4 (2)	-	-	-	4	x	-	
10-28-86	EHL Lat 8	225	Strahm & Sons	1.5	Broccoli	7:30	-	12	20	1.5 + 2.5	-	1.5 (2)	-	-	2	24	x	-	
10-28-86	EHL Lat. 11	276	Brady	3	Onions	8:00	-	10.5	13	1 + 1	-	3 (2)	-	-	2	20	x	-	
10-28-86	EHL Lat. 5	164	Strahm Farms	3	Onions	6:00	-	12	10	1 + -	-	3 (2)	-	-	-	3	x	-	
10-29-86	EHL Sid n	160A	Nakasawa	2.5	Lettuce	7:30	-	12	30	1.5 + 2	-	2.5 (2)	-	-	3	10	x	-	
10-29-86	EHL Lat. 11	276	Brady	3	Onions	7:30	-	11	20	1 + 1.5	-	3 (2)	-	-	2	11	x	-	
10-29-86	EHL Lat. 10	250B	Strahm & Sons	4.5	Carrots	7:45	-	12	20	1.5 + 2.5	4.5	- (3)	-	-	1	4.5	x	-	Moved to Pear 11 in P.M.
10-29-86	So. Alam	60	Brady	4.5	Carrots	8:10	-	12	13	.5 + 1	-	4 (2)	-	-	4	10Z	x	-	
10-29-86	So. Alam	70	Noriega	1	RyeGrass	8:27	-	12	13	.5 + 1	-	1 (2)	-	-	5	10Z	-	-	Flat irrigtion
10-29-86	Ash	187	Chell	3	Lettuce	8:45	-	12	25	1 + 2.5	-	3 (1)	-	3	-	24	x	-	
10-29-86	Mesa Lat. 4	54	Holdridge	1.5	Carrots	7:40	-	12	20	1.5 + -	-	1.5 (2)	-	-	-	1.5	x	-	
10-29-86	Peach	2	Brady	4	Lettuce	-	5:38	13	20	1 + -	4	- (3)	-	-	-	29	x	-	Water used for new orders
10-30-86	Peach	2	Brady	4	Carrots	-	7:20	12	24	1 + -	4	- (3)	-	-	-	49	x	-	Water used for new orders
10-30-86	EHL Lat. 5	164	Strahm Farms	2.5	Onions	6:00	-	12	15	1 + -	-	2.5 (2)	-	-	-	2.5	x	-	
10-30-86	Pear	11	Brady	3	Carrots	7:00	-	12	10	1.5 + -	-	3 (2)	-	1.5	1	61	x	-	
10-30-86	Mesa Lat. 3	84	Strahm & Sons	1.5	Lettuce	8:00	-	11	27	1 + 2	-	1.5 (2)	1	-	3	12	x	-	
10-30-86	Ash	45A	Fornasero	1.5	Lettuce	7:30	-	12	10	1 + 1.5	-	1.5 (1)	-	2	4	108	x	-	
10-30-86	Ash	212	Pemberton	3	Cabbage/ Lettuce	10:00	-	GC7	10	1.5 + 1.5	-	3 (1)	3	15	-	23	x	-	Pump broken-hrs. unknown
10-31-86	Palm	7	Luette Farms	3	Alfalfa	7:03	-	24	10	.5 + -	-	- -	-	-	-	20	Flat	-	9 p.m change to 24 hr. run
10-31-86	Pear	11	Brady	4.5	Carrots	6:30	-	12	9	1 + -	-	- (3)	.5	1	2	82	x	-	Water used for canal oper.
10-31-86	EHL Lat. 11	276	Brady	2.5	Onions	6:30	-	11	15	1 + 1	-	2.5 (2)	-	-	-	2.5	x	-	
10-31-86	So. Alam	60	Brady	4	Carrots	7:00	-	12	22	.5 + 1.5	-	4 (2)	-	-	4	46	x	-	
10-31-86	Mesa Lat 3	84	Strahm & Sons	1.5	Lettuce	8:00	-	11.5	10	2 + -	-	1.5 (2)	-	1	2	15	x	-	
10-31-86	Ash	187	Chell	2	Lettuce	8:30	-	12	25	1 + 2.5	-	2 (1)	7	2	3	30	x		
11-01-86	So. Alam	68	West-Gro	4	Onions	8:30	-	12	22	.5 + 1.5	-	4 (2	-	-	5	54	x	-	
11-01-86	EHL Lat. 5	164	Strahm Farms	3	Lettuce	-	5:42	12	14	1.5 + -	-	3 (2)	-	-	-	3	x	-	
11-01-86	Pear	11	Brady	2	Carrots	7:00	-	12	17	1 + 1.5	-	2 (2)	-	-	1	60	x	-	
11-01-86	EHL Lat. 8	216	Nakasawa	1.5	Lettuce	6:30	-	12	13	.5 + .5	-	1 (2)	-	-	1	4.5	x	-	
11-01-86	Palmetto	4	Nakasawa	1	Lettuce	7:00	-	11	30	1 + 1	-	1 (2)	-	-	-	4	x	-	
11-02-86	Oat	4	Fifield	2.5	Lettuce	6:10	-	12	36	1 + 2	-	3 (2)	-	-	-	15.5	x	-	
11-02-86	So. Alamo	26A	Henvielle	1	Cauliflwr	6:30	-	12	20	.5 + 1.5	-	- (3)	-	-	2	34	x	-	Water used for canal oper.
11-02-87	Pomelo	5	Hawk	3.5	Lettuce	6:50	-	12	17	2 + -	-	3.5 (2)	1.7	-	-	12	x	-	
11-02-86	EHL Lat. 11	276	Brady	2.5	Onions	7:30	-	11	22	1 + 2	-	2.5 (2)	-	-	2	5	x	-	
11-02-86	EHL Lat. 8	225	Strahm & Sons	1.5	Broccoli	7:30	-	12	36	1 + 2	-	1.5 (2)	-	-	-	1.5	x	-	

12-HOUR.4

12-HOUR RUN DATA - OCTOBER 8 THRU NOVEMBER 21

Date	Can	Gate	Name	Order CFS	Crop	Order A.M.	Start P.M.	Hrs. Run	Vehicle Miles	Man Hrs.	O.T. +Hrs.	CFS Moved	CFS Removed	Canal Discharge A.M. CFS	Canal Discharge P.M. CFS	Gates Changed	Q @ Hdg. CFS	Irrigation Sprinkle	Irrigation Row	Comments
11-03-86	So. Al	31	Brady	4.5	Carrots	6:20	-	12	13	.5	+ 1	-	4.5 (2)	-	-	3	76	x	-	
11-03-86	Peach	2	Brady	2.5	Lettuce	7:00	-	11	13	1	+ 1	-	2.5 (2)	-	-	-	27	x	-	
11-03-86	EHL La	11	276	Brady	2.5	Onions	7:30	-	11	12	1	+ 1.5	-	2.5 (2)	-	-	-	2	x	-
11-03-86	EHL La	1	137	Vessey	3	Lettuce	7:30	-	12	19	.5	+ 1	-	3 (2)	-	-	4	40	x	-
11-03-86	EHL Sd	in	160A	Nakasawa	2	Lettuce	8:00	-	12	18	.5	+ .5	-	2 (2)	-	-	5	40	x	-
11-03-86	So. Al	n	114	Strahm	1.5	Lettuce	8:40	-	12	14	.5	+ 1	-	1.5 (2)	-	-	6	76	x	-
11-04-86	EHL Sd	in	160A	Nakasawa	2	Lettuce	7:30	-	12	25	.5	+ 1.5	-	2 (2)	-	-	4	32	x	-
11-04-86	Ash	206	Haines	1.5	Broccoli	9:10	-	12	12	.5	+ 1	-	1.5 (1)	3.8	3.2	-	33	x	-	Farmer refused wtr @ 6:15 am
11-04-86	EHL La	8	225	Strahm & Sons	1.5															
11-04-86	Plum	35	Schaffner	2	Lettuce	8:30	-	12	10	1	+ 2	-	2 (2)	-	1.3	2	25	x	-	
11-04-86	Ash	148	Hagco	4.5	Onions	8:30	-	12	18	.5	+ 1	-	4.5 (1)	3.8	3.2	-	22	x	-	
11-04-86	Palmet	4	Nakasawa	1	Lettuce	7:30	-	12	15	1.5	+ -	-	1 (2)	-	-	1	2	x	-	
11-04-86	Ash	158	Hagco	2	Onions	8:45	-	12	12	.5	+ 1	-	2 (1)	3.8	3.2	-	22	x	-	
11-05-86	EHL La	5	164	Strahm Farms	2.5	Onions	6:00	-	12	10	1	+ -	-	2.5 (2)	-	-	2	2.5	x	-	
11-05-86	Palmet	5	Nakasawa	1	Lettuce	7:00	-	11	7	.5	+ .5	-	1 (1)	1.7	1.7	-	-	x	-	Palmetto Hdg. leaks 1.7 cfs
11-05-86	Palmet	4	Nakasawa	1	Lettuce	7:00	-	11	7	.5	+ .5	-	1 (1)	1.7	1.7	-	-	x	-	Palmetto Hdg. leaks 1.7 cfs
11-05-86	EHL La	11	276	Brady	2.5	Onions	7:30	-	11	10	1	+ 1	-	2.5 (2)	-	-	2	6	x	-	
11-05-86	Ash	144	Haines	1.5	Lettuce	7:40	-	12	27	1	+ 2	-	1.5 (1)	9.8	3.2	3	52	x	-	
11-05-86	So. Al	n	114	Strahm & Sons	1.5	Lettuce	8:30	-	12	17	.5	+ 1.5	-	1.5 (2)	-	-	8	46	x	-
11-05-86	So. Al	n	68	West-Gro	4.5	Onions	8:15	-	12	17	.5	+ 1.5	-	4.5 (2)	-	-	6	46	x	-
11-06-86	So. Al	n	114	Strahm & Sons	1.5	Lettuce	8:30	-	12	27	.5	+ 2	-	1.5 (3)	1	-	10	40	x	-	Wtr used for canal oper.
11-07-86	EHL La	5	164	Strahm & Sons	2.5	Onions	5:30	-	12	29	1	+ 1.5	-	3 (2)	-	1	-	2.5	x	-	
11-07-86	EHL La	11	276	Brady	2.5	Onions	7:00	-	12	18	1	+ 1.5	-	3 (2)	-	.5	-	18	x	-	
11-07-86	Pear	11	Brady	4.5	Carrots	7:00	-	12	25	1	+ 1.5	-	4.5 (2)	-	-	1	31	x	-	
11-08-86	EHL Sd	in	128	LaBrucherie	1.5	Carrots	6:10	-	12	18	.5	+ -	-	2 (2)	-	-	-	2	x	-
11-08-86	EHL La	14	305	Grizzle	3	Lettuce	6:55	-	12	10	1	+ -	-	3 (2)	-	-	-	5	x	-
11-08-86	Oat	4	Fifield	4.5	Lettuce	7:00	-	12	16	1	+ 2	-	3.5 (2)	-	-	-	23	x	-	
11-08-86	Ash	171	Strahm & Sons	4.5	Broccoli	8:30	-	12	22	.5	+ 1.5	-	4.5 (2)	3	1.4	5	34	x	-	
11-08-86	Ash	148	Hagco	2	Onions	8:00	-	12	22	.5	+ 1.5	-	2 (2)	3	1.4	5	60	x	-	
11-09-86	So. Al	26A	Henvielle	1.5	Broccoli	6:30	-	12	33	.5	+ 2	-	2 (3)	-	-	1	9	x	-	Wtr used for canal oper.
11-09-86	Pear	11	Bradley	4.5	Carrots	7:00	-	12	28	1	+ 1	-	4 (2)	-	-	-	32	x	-	
11-09-86	Hess L	3	86	Strahm Farms	3.5	Lettuce	8:15	-	11	22	1.5	+ 2	-	3.5 (2)	-	-	5	21	x	-
11-09-86	Ash	171	Strahm & Sons	2.5	Broccoli	8:35	-	12	14	1	+ 1.5	-	2.5 (1)	8	3.8	3	22	x	-	
11-09-86	Ash	190	Croak	4	Alfalfa	9:20	-	12	14	.5	+ 1.5	-	4 (1)	8	3.8	2	22	Flat	-	

12-HOUR.5

12-HOUR RUN DATA - OCTOBER 8 THRU NOVEMBER 21

Date	Canal	Gate	Name	Order CFS	Crop	Order A.M.	Start P.M.	Hrs. Run	Vehicle Miles	Man Hrs. + O.T. Hrs.	CFS Moved	CFS Removed	Canal Discharge A.M. CFS	Canal Discharge P.M. CFS	Gates Changed	Q @ Hdg. CFS	Irrigation Sprinkle	Irrigation Row	Comments
11-10-86	Palmetto	4	Nakasawa	1	Lettuce	6:45	-	12	15	.5 + 1	-	1 (2)	-	1	-	23	x	-	
11-10-86	Palmetto	5	Nakasawa	1	Lettuce	6:45	-	12	16	.5 + 1	-	1 (2)	-	1	-	23	x	-	
11-10-86	EHL Lat. 11	276	Brady	2.5	Onions	7:00	-	12	16	1 + 1	-	3 (2)	-	.5	-	3	x	-	
11-10-86	Ash	171	Strahm & Sons	2.5	Broccoli	8:30	-	12	22	1 + 2	-	2.5 (1)	10	7	4	11	x	-	
11-10-86	EHL Lat 5	164	Strahm Farms	2.5	Onions	5:30	-	12	20	.5 + -	-	3 (2)	-	-	-	3	x	-	
11-11-86	So. Alamo	26A	Henvielle	1.5	Broccoli	6:30	-	12	23	.5 + .5	-	1.5 (3)	-	-	2	97	x	-	Wtr used for canal operation
11-11-86	Palmetto	4	Nakasawa	1	Lettuce	7:00	-	12	15	.5 + 1	-	1 (2)	1	-	-	19	x	-	
11-11-86	Ash	458	Hagco	3	Carrots	7:30	-	12	20	1 + 2.5	-	3 (2)	3.5	3	3	106	x	-	
11-11-86	Ash	148	Hagco	2	Carrots	7:55	-	12	17	.5 + 1	-	2 (1)	4.5	2	5	52	x	-	
11-11-86	Ash	158	Hagco	2	Onions	8:15	-	12	17	.5 + 1	2 (3	-	4.5	2	5	52	x	-	Moved to gate 156
11-12-86	Ash	12	Henvielle	3	Alfalfa	6:30	-	12	20	1 + 2	-	3 (2)	2	1	1	147	x	-	
11-12-86	So. Alamo	26A	Henvielle	1.5	Cauliflr	6:30	-	12	21	.5 + 1.5	1.5(3	-	-	-	2	124	x	-	Moved to gate 17A
11-13-86	So. Alamo	26A	Henvielle	1.5	Cauliflr	6:20	-	12	11	.5 + 1	1 (3	-	-	-	2	138	x	-	Wtr used for canal operation
11-13-86	Pine	5	LaBrucherie	4	Carrots	7:00	-	12	22	.5 + 1	-	4 (2)	-	-	1	41	x	-	
11-13-86	Ash	206	Haines	3	Cauliflr	8:30	-	10	20	1 + 2	-	3 (1)	3.8	7.8	1	33	x	-	
11-13-86	Pampas	34	Schaffner	3	Alfalfa	8:30	-	12	18	1 + 2	-	3 (2)	-	-	1	10	x	Flat	
11-13-86	So. Alamo	78	Noriega	1.5	RyeGrass	8:20	-	12	11	.5 + 1	1.5(3	-	-	-	3	138	Flat	-	Wtr used for canal operation
11-14-86	So. Alamo	26A	Henvielle	1.5	Cauliflr	6:30	-	12	21	.5 + 1.5	-	2 (2)	-	-	3	130	x	-	
11-14-86	Palmetto	4	Nakasawa	1	Lettuce	7:00	-	12	18	.5 + 1.5	-	1 (2)	-	-	1	8	x	-	
11-14-86	Ash	112C	Hamilton	1.5	Onions	7:30	-	11.5	20	1.5 + -	-	1.5 (1)	-	1	2	31	x	-	
11-15-86	So.Alamo	60	Brady	4.5	Carrots	6:30	-	12	11	.5 + 1	-	4.5 (2)	-	-	4	130	x	-	
11-15-86	So. Alamo	13	Brady	1.5	Carrots/ Onions	6:35	-	12	18	.5 + 1.5	-	1.5 (2)	-	-	2	130	x	-	
11-15-86	Ash	206	Haines	2	Broccoli	9:05	-	12	25	1 + 2	-	2 (1)	4.6	-	1	24	x	-	
11-15-86	Palmetto	4	Nakasawa	1	Lettuce	7:00	-	12	13	.5 + 1	-	1 (2)	1.5	1.5	1	3	x	-	
11-15-86	Palmetto	5	Nakasawa	1	Lettuce	7:00	-	12	13	.5 + 1	-	1 (2)	1.5	1.5	1	3	x	-	
11-16-86	Pine	5	LaBrucherie	4	Carrots	6:30	-	11	16	.5 + 1	-	4 (2)	-	-	-	4	x	-	
11-16-86	Palm	5	LaBrucherie	4	Carrots	6:30	-	11	16	.5 + 1	-	4 (2)	-	-	2	2	x	-	
11-16-86	So. Alamo	26A	Henvielle	1.5	Cauliflr	6:20	-	12	21	.5 + 1	-	1.5 (2)	-	-	4	101	x	-	
11-16-86	So. Alamo	57	LaBrucherie	4.5	Carrots	7:30	-	12	10	.5 + 1	-	4.5 (2)	-	-	3	101	x	-	
11-16-86	So. Alamo	60	Brady	3.5	Carrots	7:30	-	12	10	.5 + .5	-	3.5 (2)	-	-	4	101	x	-	

12-HOUR.6

12-HOUR RUN DATA - OCTOBER 8 THRU NOVEMBER 21

Date	Con't	Gate	Name	Order CFS	Crop	Order A.M.	Start P.M.	Hrs. Run	Vehicle Miles	Man Hrs.+ O.T. Hrs.	CFS Moved	CFS Removed	Canal Discharge A.M. CFS	Canal Discharge P.M. CFS	Gates Changed	Q @ Hdg. CFS	Irrigation Sprinkle	Irrigation Row	Comments
11-16-86	Pansy	3A	Hawk	3.5	Lettuce	7:40	-	12	34	1 + 1.5	-	3 (2)	-	-	-	3.5	x	-	
11-17-86	Palmetto	5	Nakasawa	1	Lettuce	7:00	-	12	15	.5 + 1.5	-	1 (2)	1.5	1.5	1	3	x	-	
11-17-86	Ash	450	Hagco	3	Carrots	7:30	-	12	35	1 + 2.5	-	3 (2)	2.4	2.0	1	79	x	-	
11-17-86	Ash	158	Hagco	2	Onions	7:40	-	12	25	1 + 2	-	2 (1)	3.2	1.4	1	22	x	-	
11-19-86	Palmetto	5	Nakasawa	1	Lettuce	7:00	-	12	15	.5 + 1.5	-	1 (2)	1	1	1	2	x	-	
11-20-86	Ash	112C	Hamilton	1.5	Onions	7:15	-	12	31	1 + 2	-	1.5 (1)	3.2	1.8	1	14	x	-	
11-20-86	So. Alamo	39	Brady	4	Carrots	6:30	-	12	18	.5 + 2	-	4 (3)	-	-	6	62	x	-	Htr. used for canal operatic
11-20-86	Palmetto	4	Nakasawa	1	Lettuce	6:50	-	12	10	1 + 1	-	1 (2)	-	-	-	4	x	-	
11-20-86	EHL Lot 14	310	Grizzle	3	Alfalfa	7:00	-	12	10	1 + 1	-	3 (2)	-	-	4	13	x	-	
11-20-86	Pepper	28A	Adams	4.5	Alfalfa	9:00	-	12	20	1 + 1	-	4.5 (2)	-	-	-	17	Flat	-	
11-21-86	Hesa Lot 5	65	Strahm Farms	4.5	Carrots	7:10	-	12	12	.5 + -	-	4.5 (2)	-	-	1	5	x	-	
11-21-86	Palm	5	LeBrucherie	4	Carrots	6:00	-	12	17	2 + -	-	4 (2)	-	-	2	4	x	-	
11-21-86	Palmetto	4	Nakasawa	1	Lettuce	6:45	-	12	12	1 + -	-	1 (2)	1	1.8	-	8	x	-	
11-22-86	Pear	11	Brady	3.5	Carrots	7:00	-	12	16	1 + 1.5	-	3.5 (2)	-	-	-	40	x	-	14 orders of 12 hr. runs wer changed to 24 hrs. later in day during month of Nov.
11-22-86	Ash	171	Strahm & Sons	4.5	Cauliflr	8:15	-	12	27	1 + 2	-	4.5 (1)	3.2	1.4	2	10	x	-	

12-HOUR.7

Evaluation of the results was based on the following assumptions:

1) 40 percent the of water returned would have been moved by the District to another field during the night,

2) 60 percent of water returned would have been spilled through tailwater structure into a District drain,

3) 85 percent distribution efficiency due to seepage, operational discharge, etc.

Findings:

Water deliveries for the 45 day test period totaled 482 AF. Applying the assumptions outlined above an estimate of conserved water can be derived.

Water conserved = 482 AF x 60% x 85% = 246 AF

The program was favored by virtually everyone that had the opportunity to use it. Most growers said they were willing to pay extra for the service.

During the trial period, approximately five percent of the orders were for 12-hour delivery. This percentage would vary during the year and would be higher during peak germination of vegetables.

Further examination of the benefits of implementing a 12-hour run is justified. Recommendation for implementation if this program is adopted are:

1) The water rate for water delivered in 12-hour periods shall be the same as agricultural water deliveries in 24-hour increments.

2) A service charge of $50 shall be made for water ordered in 12-hour increments.

3) Water users with pump irrigation systems shall be responsible for continuing their water delivery during the entire 12-hour run, including during mechanical failures.

4) If water is diverted to the IID's drain in excess of one hour, the water user shall receive an assessment of $100. For each additional hour that the water is diverted the assessment shall be an additional $50 per hour.

Although many problems were encountered during the 45 day trial period, they do not appear to be insurmountable. Providing 12-hour service is costly and would require more personnel and storage capacity if adopted system wide. If growers are willing to pay for 12-hour service (they have indicated that they are) and appropriate rules can be worked out, the 12-hour run could be a viable way to conserve water.

2.5 Underground Storage and Recovery

The ability to store water once it has reached the Imperial Valley through the All-American Canal is essential to the IID's water conservation effort. Additional storage facilities could provide a way of retaining water which would otherwise flow to the Salton Sea and enable the IID to store conserved water for later use.

The IID has provided historical data from the East Mesa Test Well program to the USBR for their continued investigation into the

possibility of storing excess Colorado River flows underground in the East Mesa Area. The IID monitors the ground water table within the East Mesa area and has records dating back more than 30 years (Exhibit 4). In addition, the IID initiated an investigation into the possible use of aquifers on the west side of the Imperial Valley for underground storage and recovery.

AQUIFERS UNDER STUDY

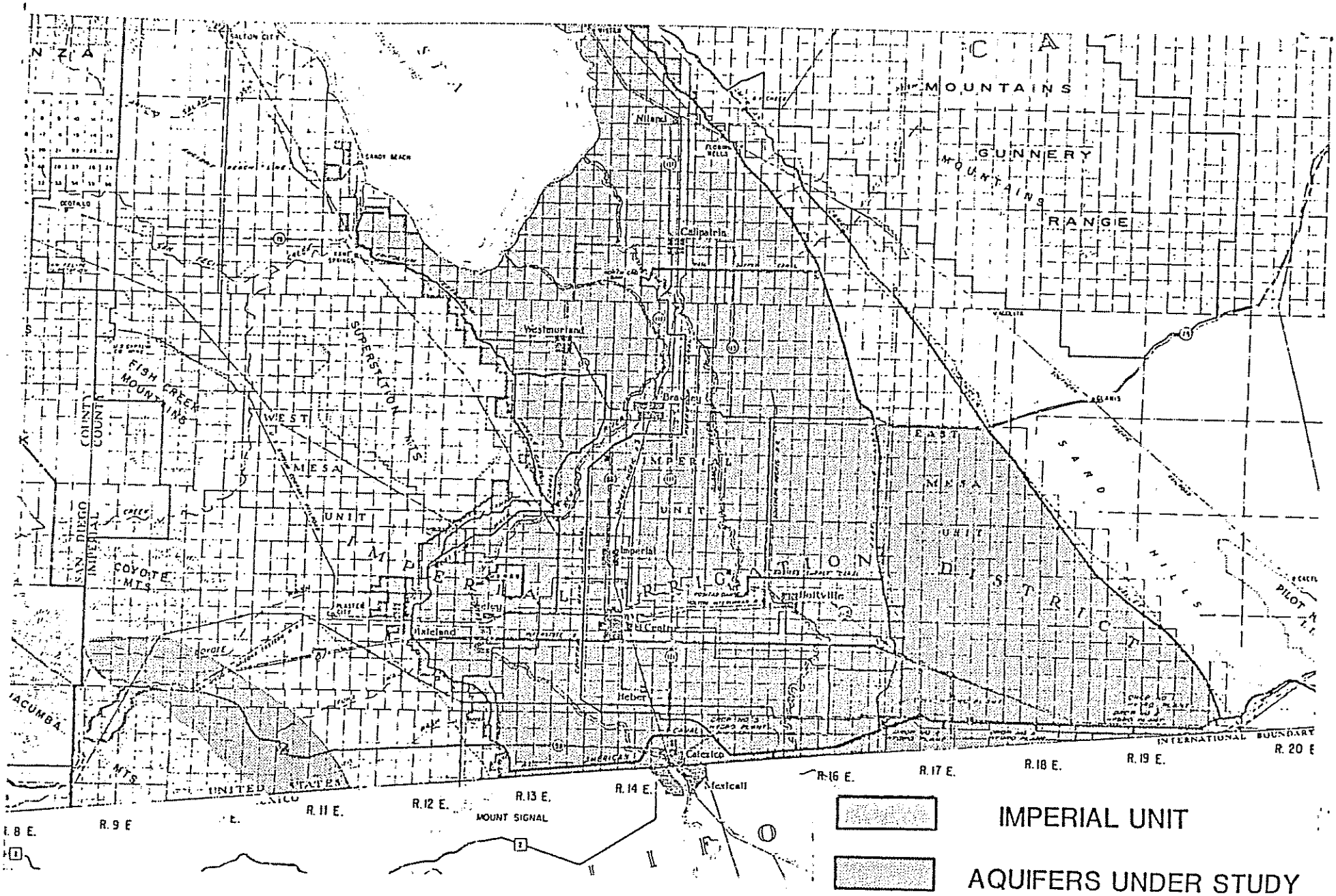


EXHIBIT 4

2.6 Lateral Fluctuation Study

The IID and the U.S. Water Conservation Laboratory of Phoenix, Arizona are conducting a joint project to study the causes and effects of water level fluctuations in an open channel irrigation system. Lateral water surface fluctuations and subsequent variability of water deliveries adversely effect irrigation efficiency. To consistently maintain high irrigation efficiencies, predictable nonfluctuating deliveries are required. The goal of this program is to identify structural problems and operational procedures which cause fluctuations in flow, resulting in variable deliveries to water users.

Data collection began May 27, 1986 and continued through July 23, 1987. A total of 56 electronic data loggers were used to monitor water levels at 76 sites along two laterals. The data loggers were programmed to take one reading every 15 minutes.

A technical paper entitled "Investigation of Main Supply Canal and Lateral Fluctuations" was prepared by IID staff for the 1987 ASCE Specialty Conference on Irrigation Systems for the 21st Century (Exhibit 5). This paper summarized a preliminary analysis of main supply canal fluctuations and flow variability within the laterals using the first seven months of data.

Data analysis is continuing, and with the recent installation of a new mini computer for use by the IID's Engineering Section, the ability to process this large data bank has been greatly increased.

INVESTIGATION OF MAIN SUPPLY CANAL AND LATERAL FLUCTUATIONS

Karen I. Holdsworth[1] and
Robert J. Lang[2], M. ASCE

ABSTRACT: The Imperial Irrigation District and the U.S. Water Conservation Laboratory of Phoenix, Arizona are conducting a joint project to study the causes and effects of water level fluctuations in an open channel irrigation system. Two distribution laterals and the associated main supply canal are being monitored. Water depth measurements are taken at 76 sites. An analysis of water level fluctuations at the inlet of each lateral indicated that main supply canal fluctuations affect both laterals equally even though one lateral is located 700 ft (210 m) upstream of a control structure and the other is 14,800 ft (4,500 m) upstream of a control structure. Main supply canal water level fluctuations are less than four percent. Flow fluctuations within each lateral tend to increase in the direction of flow.

INTRODUCTION

The Imperial Irrigation District operates 1,680 miles (2,700 km) of canal which serves 465,000 acres (188,325 ha) of farmland. During a given year the District can distribute 2,500,000 acre-ft (3.08 x 10^9 m^3) of water through 5,600 delivery gates. All of this water comes from the Colorado River via the All-American Canal.

The District is currently involved in a joint project with the USDA Water Conservation Laboratory in Phoenix, Arizona to study causes and effects of water level fluctuations along the canal system. There are several possible causes for water level fluctuations. This paper focuses on the characteristics and impacts of main supply canal fluctuations on distribution laterals. The characteristics of flow fluctuations within the distribution laterals are also evaluated.

STUDY SITE

Figure 1 shows the main supply canal and laterals selected for study. The East Highline (EHL) Canal is 45 miles (72 km) long and has a capacity of 2,600 cfs (74 m^3/s) at its heading. More than 70 distribution laterals are served by the EHL Canal. Seven check struc-

[1] Assistant Engineer, Imperial Irrigation District, P. O. BOX 937, Imperial, CA. 92251.

[2] Chief Civil Engineer, Imperial Irrigation District, P. O. Box 937, Imperial, CA. 92251.

EXHIBIT 5-1

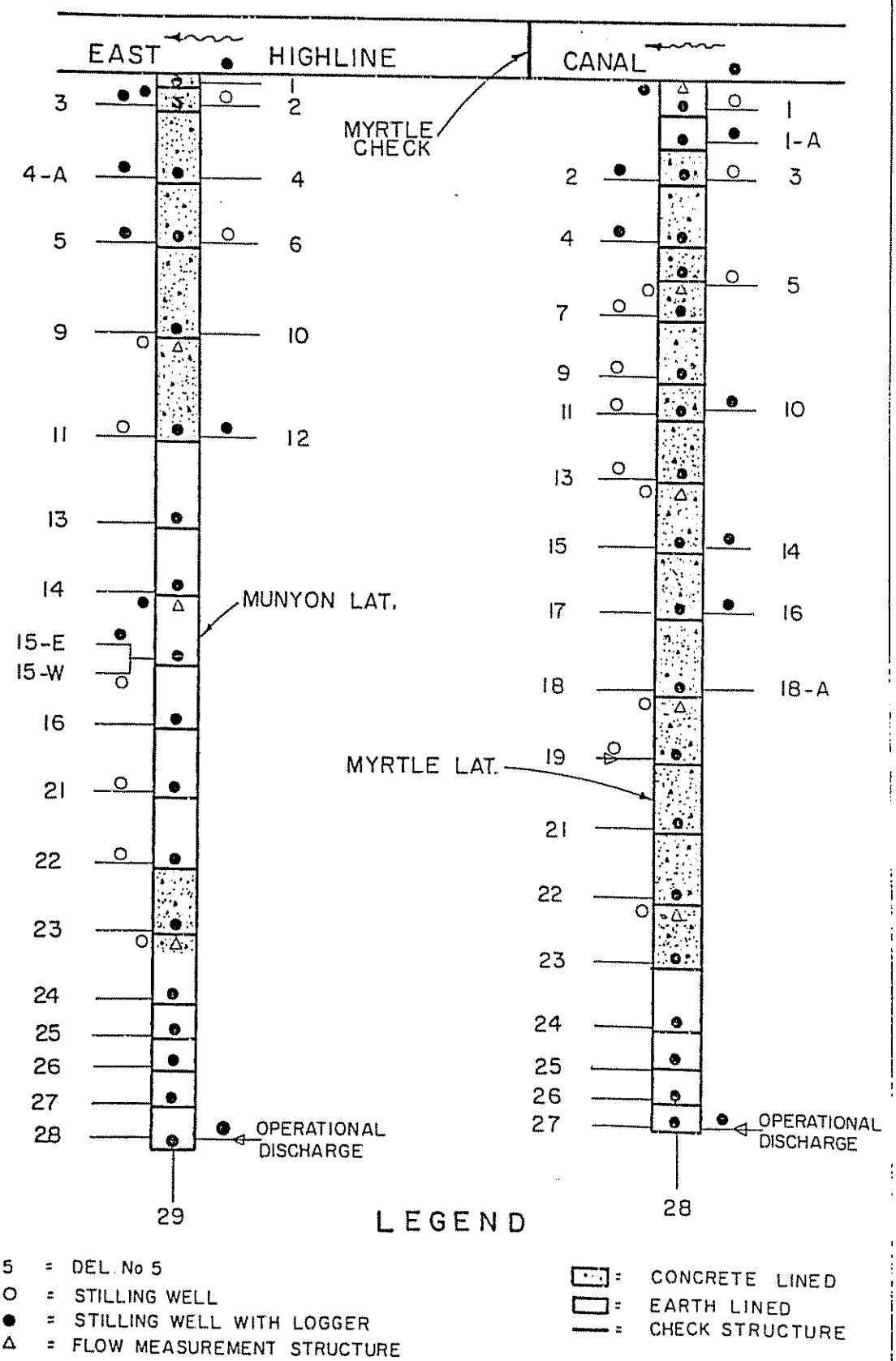


Figure 1. Main supply canal and distribution laterals under study.

EXHIBIT 5-2

tures are used to regulate flow along the EHL and maintain pond levels for the distribution laterals. These checks are operated remotely from a central water dispatch office.

The heading of Myrtle lateral is 700 ft (210 m) upstream of Myrtle Check; Munyon heading is about 2,000 ft (610 m) downstream of the same check. The level of the EHL at Munyon is controlled by Standard Check which is 14,800 ft (4,500 m) downstream from Munyon. Each lateral is just under 8 miles long (13 km). Myrtle has a capacity of 75 cfs (2.1 m^3/s) at its heading; Munyon has a capacity of 80 cfs (2.3 m^3/s). Vertical slide gates are used to regulate flow into the distribution laterals. These gates are adjusted manually by a Hydrographer in the morning and checked periodically throughout the day and night by patrolmen.

DATA COLLECTION

Data collection began at the end of May 1986 and is still in progress at this writing (3/87). Figure 1 shows a schematic of each lateral and existing instrumentation. A total of 56 electronic data loggers are monitoring water levels at 76 sites along the two laterals. There are three different types of stilling well installations: those which monitor pond depth just upstream of each check in the lateral; those which measure water depth in delivery ditches; and those which are used in conjunction with a broad-crested weir to measure flow. Each well is equipped with a float and pulley transducer to measure water level. The data loggers have been programmed to take one reading every 15 minutes. Those loggers which monitor broad-crested weirs have been programmed to calculate and report flow as well as water depth.

Each logger is equipped with a removable data storage pack (DSP). These packs are changed weekly. Data are transferred from the DSP to an IBM AT computer and then permanently stored on floppy disks. The DSP's are erased and reused. Approximately 125 DSP's are being used on a rotating basis.

DATA ANALYSIS

Stability of the EHL Canal.--- The District delivers water in fixed 24-hour periods. Each morning a Hydrographer measures the head on the lateral headgates and adjusts the gate opening to meet total flow requirements. The gates operate under orifice flow. Once the headgates are set, Zanjeros (ditch riders) travel up and down the lateral setting checks and farm turnouts to distribute the water as ordered. Due to this method of operation, a "water day" at this particular section of the EHL Canal is defined as starting at 7:00 a.m. and ending at 6:45 a.m. the following day.

Depth of flow in the EHL was measured near the inlets of Myrtle and Munyon Laterals. Measurements were taken with respect to the bottom of the gate opening at each lateral. The 15 minute data readings have been condensed into the following "daily" statistics: average water depth, variance, standard deviation, coefficient of variation, minimum depth and maximum depth.

The average daily water depth at Myrtle was 2.88 ft (0.88 m) while the average water depth at Munyon was 3.43 ft (1.05 m). A paired t-distribution test of these two samples indicated that water depth at Munyon was significantly greater than at Myrtle.

Fluctuations from the average have been evaluated using the average daily standard deviation and average daily coefficient of variation. Average daily standard deviation was 0.098 ft (0.030 m) at Myrtle and 0.123 ft (0.037 m) at Munyon. A paired t-distribution test showed the deviation at Munyon to be significantly greater than the deviation at Myrtle.

Although deviations are greater at Munyon, mean water depth is also greater. As a result, the percent change in depth at each site is essentially equal. The average daily coefficient of variation was 0.0396 at Myrtle and 0.0390 at Munyon. A paired t-distribution test of the data showed no significant difference between the percent change in water level for the two locations.

Since the lateral headgates are set at fixed openings, any change in EHL Canal water level will cause flow in the laterals to change. It was suspected that the EHL Canal would be more stable at Myrtle, which is just upstream of a control structure. On a 24-hour basis, the EHL Canal at Myrtle proved to be more stable in terms of average deviation from mean water level. However, the percent change in water levels (or coefficients of variation) at Myrtle and Munyon are essentially equal, resulting in equivalent flow fluctuations at the heading of each lateral.

Even though lateral flows are set each morning for a 24-hour period, District operating rules allow farmers to change their orders during certain periods of the day. Typically, most changes take place before noon and after 6:00 p.m. In order to avoid including the effects of these deliberate flow changes, Myrtle and Munyon flow statistics were taken from noon to 6:00 p.m. EHL statistics were also calculated for this same period as a basis of comparison.

During the afternoon, average water depth at Munyon was still significantly greater than at Myrtle, 3.41 ft (1.04 m) and 2.85 ft (0.87 m) respectively. The standard deviations of water depth were equal at 0.041 ft (0.012 m). The combination of equal standard deviations and unequal mean water depths resulted in a slightly higher coefficient of variation for the EHL Canal at Myrtle (0.019, compared to 0.014). However, a paired t-distribution test showed that the coefficients of variation at Myrtle and Munyon are essentially equal for the 6-hour data analysis period, just as with a 24-hour data analysis period.

Flow stability within laterals.--- Flow data from the weirs on Myrtle and Munyon were analyzed from noon to 6:00 p.m. each day. As expected, a paired t-distribution test showed that the daily coefficients of variation at the first weir on Myrtle are statistically equivalent to the daily coefficients of variation at the first weir on Munyon. The average daily coefficients of variation for flow over the first weirs on Myrtle and Munyon are 0.013 and 0.011 respectively.

Figure 2 shows the percent deviation from mean flow as a function of distance from the lateral headings. For both laterals the percent deviation from mean flow increases in the downstream direction. The increase in coefficient of variation between adjacent weirs is statistically significant in most cases. This result indicates that flows become less reliable in the downstream direction.

The increase in coefficient of variation can be caused by decreasing average flow and/or increasing standard deviation in the downstream direction. Logically, average flow will decrease in the downstream direction but the trend for standard deviation is less predictable. Figures 3 and 4 show average daily flow and average daily

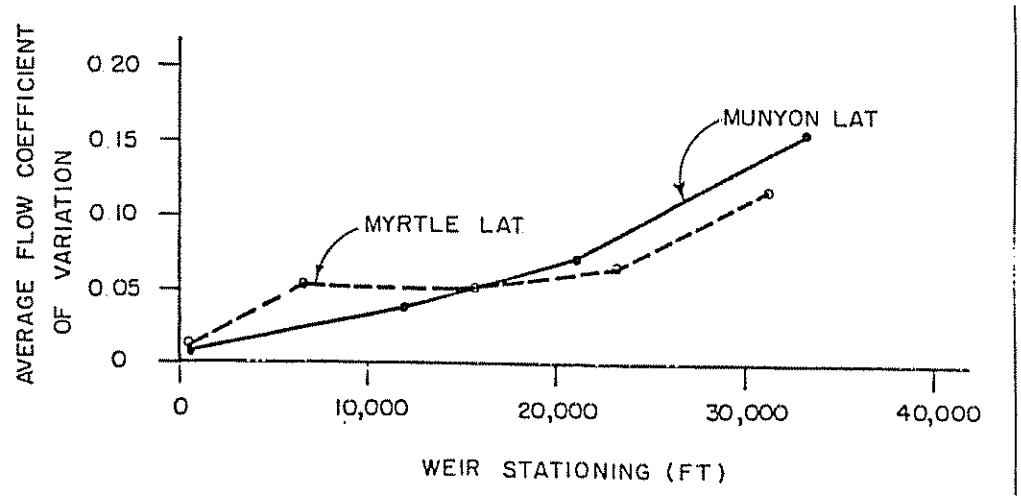


FIGURE 2. Average coefficient of variation for flow over weirs along Myrtle and Munyon Laterals. Statistics taken from noon to 6:00 p.m. daily.

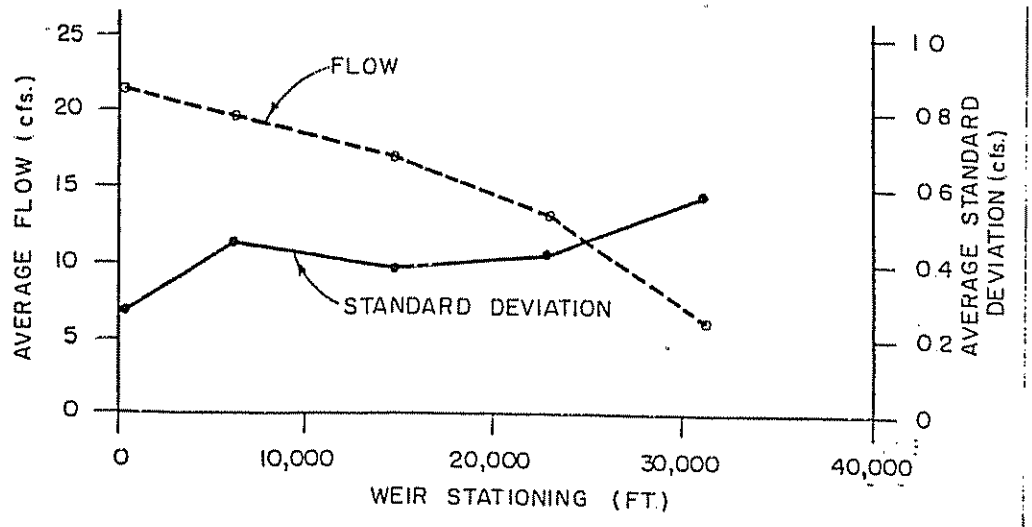


FIGURE 3. Average flow and average standard deviation of flow over weirs along Myrtle Lateral. Statistics taken from noon to 6:00 p.m. daily.

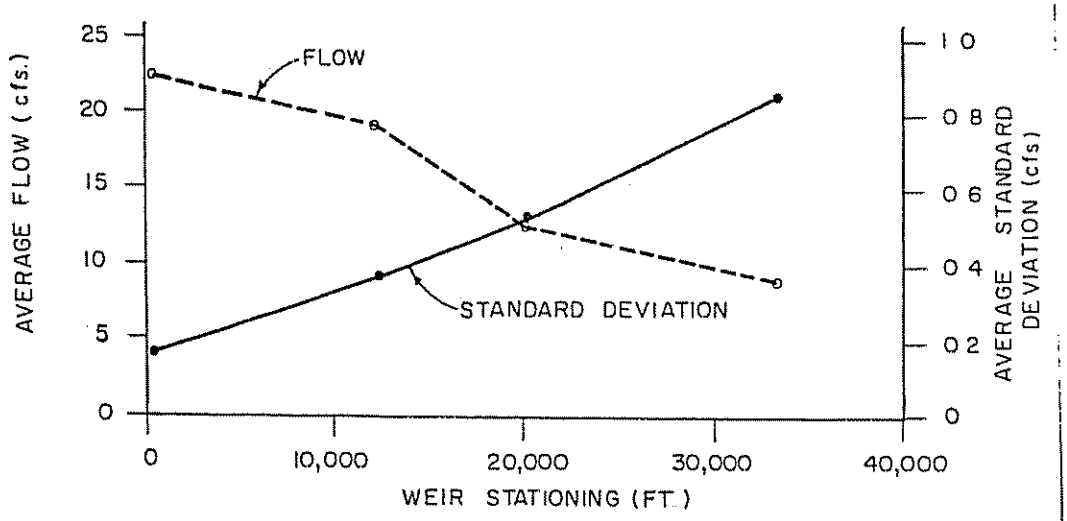


FIGURE 4. Average flow and average standard deviation of flow over weirs along Munyon Lateral. Statistics taken from noon to 6.00 p.m. daily.

standard deviation of flow along each lateral. Munyon shows a very strong increase in flow deviation in the downstream direction while Myrtle exhibits a less definite trend. Paired t-distribution tests comparing the first and last weirs on each lateral indicate that the increase in flow standard deviation on Myrtle is not statistically significant while the increase on Munyon is significant.

CONCLUSION

Data are being gathered from two distribution laterals (Myrtle and Munyon) and a main supply canal (EHL) to characterize flow and water level fluctuations along the canal system.

A comparison of water level fluctuation at the inlets to Myrtle and Munyon shows that, when data are analyzed over a 24-hour period, EHL Canal fluctuations are greater at Munyon. The average water level at Munyon is greater than at Myrtle resulting in an equal percent change in water level at Myrtle and Munyon.

When data are analyzed over a 6-hour period (noon to 6.00 p.m.), EHL Canal fluctuations are equivalent at Myrtle and Munyon. The average water level at Munyon is greater than at Myrtle. The percent change in water level remained statistically equivalent for the two sites. Since the percent change in water level is equivalent at both laterals, the EHL Canal causes the same amount of fluctuation in each lateral. Analysis of flows at the heading of each lateral confirms that average flow deviations are equivalent for the two laterals.

Analysis of flow data from weirs located along the length of each lateral indicated a general trend of increasing fluctuation with distance from the lateral headings. This increase in fluctuation is much more pronounced on Munyon Lateral. Although Myrtle exhibits increased fluctuation in the direction of flow, this increase is not statistically significant. Further study is needed to determine why the degree of fluctuation changes from one location to the next.

Now that the magnitudes of fluctuations have been characterized throughout the two laterals, possible causes can be determined. There are several possible causes of water level fluctuations including:

1. The release of water which is ponded behind a check gate.
2. Changing a delivery gate setting during the 24-hour delivery period.
3. Water backing up in a delivery ditch, thus reducing flow through the delivery gate.
4. An increase or decrease in the level of a main supply canal.
5. Shifting a delivery from one gate to another during the 24-hour delivery period.

As shown by the previous data, main supply canal fluctuations cause an equal amount of flow instability in each lateral even though Myrtle is located much closer to a check structure which stabilizes water level. Myrtle Lateral is only 700 ft. upstream of a check structure while Munyon is 14,800 ft. upstream from a controlling check structure. It was previously thought that fluctuations would be greater at the heading of Munyon because of its greater distance from a control structure.

One possible solution to reduce the impact of main supply canal fluctuations would be to install lateral headgates which automatically adjust for water level changes in order to hold flow constant. However, automatic gates will not solve the fluctuation problem completely. As indicated by the increasing magnitude of fluctuations with distance from the lateral heading, there are factors at work within the lateral which cause instability. There are several possible causes for increasing fluctuation within the lateral including those listed above. A more detailed analysis is needed to determine which factors contribute to flow instability and the magnitude of their contribution. Once the causes have been determined, appropriate operational and/or structural changes can be made to reduce fluctuations and thus increase water delivery accuracy.

The U.S. Water Conservation Laboratory in Phoenix is also working with the data. Once the data is analyzed to determine the causes of fluctuations, appropriate operational and/or structural changes can be implemented to increase water delivery accuracy.

2.7 USBR/IID Cooperative Study

USBR's Concrete Lining and System Improvement Study included a study to determine seepage losses from the East Highline Canal (EHL).

Flow data from two IID water record books have been entered into a database. Records from January 1978 to October 1986 were input from the Remote Control Log Sheets and the Daily Water Records.

Partial summaries have been received from the USBR in the form of annual discharge summaries, tabulated as mean daily flow for each lateral served by the EHL Canal.

Analysis of the data provided by the IID will be made by USBR staff. Ultimately, the cost effectiveness of concrete lining the EHL Canal is to be determined.

2.8 State Water Conservation Loan Programs

THE CLEAN WATER BOND LAW OF 1984

Three projects submitted by the IID have been approved by the Department of Water Resources (DWR) for funds for construction. Each is in a different stage of development.

The Trifolium Extension Reservoir is currently under construction. This facility will be the first to be completed under the loan program. Approximately 4,600 AF of water are estimated to be conserved annually. More details about this project are discussed in Section 3.3, Regulating Reservoirs, of this report.

Final approval for concrete lining two miles of the South Alamo Canal is imminent. Construction is scheduled for October or November of 1988. Because it is typical of other IID projects, construction will be completed within a two-month period and operation will begin immediately thereafter. Annual water savings are estimated at 1,510 AF.

DWR has approved funding for a third project. IID staff is nearing completion on a design for a lateral interceptor canal. Operational spill from eight laterals will be channeled through the interceptor and collected in a 150-AF reservoir. Conserved water will then by pumped to the head of another lateral system downstream of the reservoir. Pending final design approval from DWR, construction is scheduled for the latter part of 1989. The elimination of operational spill and increased flexibility will conserve approximately 2,200 AF annually.

WATER CONSERVATION AND WATER QUALITY ACT OF 1986

Several other projects have been submitted by the IID for funding consideration under the 1986 Act.

Two concrete lining projects were submitted; the remaining 3.2 miles of earth section at the South Alamo Canal and 2.4 miles of the Acacia Canal. A total of 2,890 AF is estimated to be conserved annually.

"Z" Lateral Reservoir was also submitted for consideration. Similar in design and operation to Trifolium Extension Reservoir and the four existing reservoirs, this proposed project will continue the IID's effort to construct reservoirs on a regular basis. 3,854 AF are estimated to be conserved annually.

A fourth proposed project would improve operations at the Sperber Reservoir. Gravity flows are currently used to discharge water into a canal immediately downstream of the reservoir. A proposed pump outlet structure would increase operational flexibility by allowing discharges to be made to an adjacent lateral upstream of the reservoir and conserve 465 AF annually.

2.9 Implementation Plan

In anticipation of other large conservation projects in the future, a comprehensive Implementation Plan was completed in 1987. The plan covers all proposed water conservation projects, both in

the IID's distribution system and on-farm that are currently planned to be accomplished over the 35-year planning period beginning in 1989. The Implementation Plan contains implementation strategy, schedules, project descriptions and cost data necessary for the cost effective and efficient execution of an expanded water conservation program.

Table 1 shows the capital, operation and maintenance and amounts of water to be conserved by the individual conservation projects. Also included are mitigation and legal contingency expenditures.

The Implementation Plan provides for conservation of 367,900 AF of water annually. The plan will be periodically reviewed, expanded and modified so that it will continue to serve as the primary implementation document.

WATER CONSERVATION PROGRAM COST

PROGRAM LIFE, YEARS: 35

	CAPITAL 1989 $	ANNUAL O&M 1989 $	ANNUAL CONSERVE acre-fee
CANAL LINING			
ALL AMERICAN			
Pilot Knob - Drop #1	$42,649,000	$17,200	51,0
EAST HIGHLINE	$52,581,000	$48,500	46,0
CENTRAL MAIN	$25,202,000	$22,000	5,2
WESTSIDE MAIN	$41,745,000	$21,500	4,7
VAIL SUPPLY CANAL	$1,331,000	$7,000	2,0
ROSITAS SUPPLY CANAL	$1,251,000	$5,200	2,0
LATERALS	$53,471,000	$127,000	38,5
PIPELINE	$42,391,000	$7,500	3,5
RESERVOIRS			
AAC RESERVOIR	$32,700,000	$150,000	8,0
TRIFOLIUM	$1,766,100	$22,800	4,6
Z	$1,435,000	$11,200	3,0
MID-LATERALS	$6,670,000	$218,000	6,5
NON LEAK GATES	$1,536,000	$107,700	10,0
WATER RECOVERY			
DWR INTERCEPTOR	$670,000	$10,300	3,6
MODIFIED EAST LOWLINE	$9,359,000	$21,500	13,0
TRIFOLIUM COLLECTOR	$4,034,000	$22,800	5,0
WISTER COLLECTOR	$5,492,000	$27,400	9,4
AUTOMATION	$45,353,000	$586,000	34,0
LAT. FLUCTUATION STUDY		$80,800	
INCENTIVE PROGRAMS, DIST. COST		$484,600	12,0
TAILWATER ASSESSMENT		$538,500	5,0
PROGRAM PLANNING AND DESIGN		$1,346,000	
IRRIGATION WATER MANAGEMENT		$306,900	3,0
PUMPBACK SYSTEMS	$138,313,000	$17,323,000	77,8
FARMER INCENTIVE		$6,287,000	
SALINITY PRODUCTION LOSSES		$17,882,000	
LAND LEVELING	$14,540,000	$2,908,000	20,0
HYDRO POWER REPLACEMENT		$1,707,000	
SALINITY CONTROL FUND 5%		$3,607,500	
MITIGATION	$35,778,000	$646,200	
SALTON SEA EVAP POND	$43,080,000	$1,100,000	
LEGAL CONTINGENCY		$4,093,000	
TOTAL	$601,347,100	$59,744,100	367,9

TABLE 1

2.10 Salton Sea Studies

Part of the Water Conservation Program requires mitigating negative impacts to the Salton Sea. The Salton Sea is a valuable recreational resource to the State of California as well as to the Imperial Valley. The Federal-State Reconnaissance Report of 1969 estimated benefits from the Salton Sea to be $12,045,000 annually. The California Department of Fish and Game currently has two major projects underway in the Salton Sea area. One project will update the estimate of Salton Sea recreational benefits; the other will attempt to determine the effects of rising salinity on the Salton Sea's fish population. Because the Salton Sea is a closed basin, salinity will continue to increase and eventually destroy the existing fishery. Water conservation by the District will aggrevate the salinity problem by reducing the amount of "fresh" water flowing to the sea.

Although the IID does not anticipate being the only agency involved in efforts to preserve the Salton Sea, steps are being taken to alleviate the problem. A computer model has been developed by IID staff to simulate elevation and salinity changes under various hydrologic conditions and pumping schemes. Using this model, the IID has been able to evaluate a proposal for constructing evaporation ponds outside of the Salton Sea's perimeter. In addition to this model study, the IID has applied for a low interest loan under the Water Conservation and Water Quality Bond Law of 1986

to conduct an evaporation pond pilot study. Under this study a proposed 10-acre pond would to be constructed and filled with water from the Salton Sea.

The pond would be monitored for potentially toxic elements such as Selenium and heavy metals; chemical reactions that may take place such as the volatilization of selenium; and salt accumulation to determine pond life. The effects of salinity and temperature on evaporation rate will also be investigated.

The IID has been actively involved in the Salton Sea Task Force chartered by Governor Deukmejian. Findings from the IID's computer model study were presented for discussion at a meeting of the Salton Sea Task Force Working Group. The computer model has also been used to provide specific information to Philip Meyer, consultant to the Salton Sea Task Force.

The IID has been involved in discussions with ORMAT, a geothermal developer, concerning the possibility of constructing enhanced-evaporation solar ponds near the Salton Sea to generate electricity. These ponds, used successfully on the Dead Sea, would remove highly saline water from the Salton Sea, just as conventional evaporation ponds, but would require less area and provide the added benefit of generating electricity. After review by IID staff, representatives from ORMAT presented the solar pond alternative to the Salton Sea Task Force working group.

3.0 WATER CONSERVATION PROGRAMS

3.1 Introduction

As discussed in Section 2, IID is involved in various pilot projects and studies. After each of these is evaluated on an individual basis and its effect on the overall water conservation program is determined, field implementation is considered.

The following programs have been evaluated for field implementation and have been adopted as part of the IID Water Conservation Program. Each is targeted to conserve water from a specific area of the system or aid in quantifying the effects of the Water Conservation Program.

3.2 Tailwater Monitoring

The tailwater program was revised in 1987, combining the 13-Point and 21-Point programs into a single comprehensive 15-Point program concerning tailwater assessments and delivery adjustments to conserve water (see Exhibit 6). Table 2 is a summary of the 1987 tailwater monitoring program. District personnel checked the tailwater of 91.7 percent of the deliveries over 1 cfs. Deliveries of 1 cfs or less are normally for stock water and rural houses, which very seldom have any tailwater.

Imperial Irrigation District

RESOLUTION NO. 18-37

WHEREAS, the Board of Directors of Imperial Irrigation District has appointed a Water Conservation Advisory Board to assist the District in recognizing matters relating to water problems; and

WHEREAS, the Water Conservation Advisory Board has adopted Bylaws with the approval of the Imperial Irrigation District; and

WHEREAS, said Bylaws state in Section 1.01 therein: "The purpose for which this Board as organized is to recommend to the Board of Directors of the Imperial Irrigation District and the Imperial Valley farming community an expanded program of irrigation efficiency in system operation and farming practices."; and

WHEREAS, prevailing circumstances have caused the Advisory Board to consider revision of the rules regarding tailwater assessment and delivery adjustments to conserve water; and

WHEREAS, the Water Conservation Advisory Board has recommended in Resolution No. 87-2 that certain rules be adopted to be known as the "Rules Concerning Tailwater Assessments and Delivery Adjustments to Conserve Water," and that these rules supersede those adopted in the 13- and 21-Point Programs; and

WHEREAS, the Imperial Irrigation District Board of Directors has reviewed and modified the rules as presented by the Water Conservation Advisory Board.

Imperial Irrigation District

RULES CONCERNING TAILWATER ASSESSMENTS

AND DELIVERY ADJUSTMENTS TO CONSERVE WATER

(To Combine the 13-Point and 21-Point Water Conservation Programs)

(1) The District shall establish a penalty of $100.00 for the unauthorized adjusting of delivery gates, which results in a change in the amount of water being delivered.

(2) An inventory of surface field discharge water will be taken daily and an assessment shall be levied against all discharges which equal 15 percent or more of the water being delivered and measurement thereof shall have been taken on two successive occasions not less than nine hours apart in a 24-hour period. The term assessment used herein shall mean the quantity of water charged (in second feet and reduced to acre-feet, times the scheduled water rate) multiplied by 3 for the day in which the measurements were taken.

Should it become necessary to levy assessments against surface field discharge measuring 15 percent or more on subsequent irrigation runs for any one (1) delivery gate in a calendar quarter, each successive assessment multiplier shall be increased by one (1); i.e., 4, 5, etc. The successive assessment multiplier shall not apply during the time ground is being irrigated for seed germination purposes. Immediately following stand establishment, the successive assessment multiplier shall be increased as indicated and shall apply to the land on which water is being used in the same manner as any other land receiving water.

(3) When a first measurement shows more tailwater than is allowable for that irrigation, a reasonable attempt shall be made to notify the water user, normally by telephone. Notification by mail of an assessment or penalty will be made within 5 normal working days.

(4) Application of the assessment charge shall apply on the same basis to all types of irrigation (including the use of water ordered for mulching purposes with proper notice), with the following exceptions:

(a) The percentage of surface runoff allowed when water is being used to irrigate plowed or flat unseeded ground shall be 5 percent for the last day of said irrigation; no measureable waste shall be allowed for any previous day.

(b) When water is being run in furrows to germinate crop seeds and to establish a stand, no assessment charge shall be made unless one of the two consecutive measurements showing 15 percent or more runoff is made between 12:00 noon and 6:00 p.m.

(5) In the event a water user is receiving more than his confirmed order, said surplus shall be subtracted from surface runoff for the purpose of determining if his runoff is excessive.

EXHIBIT o-2

(6) In no event shall any water user be assessed unless his runoff exceeds the allowable percentage of his order irrespective of the quantity of water the user is receiving.

(7) Any surface runoff measurement made within 4 hours after the District has reduced the quantity of water delivered shall apply to the order in effect before said change.

(8) The application of an assessment charge based on waste measured after the delivery gate is closed shall apply on the same basis as when water was actually running. Any assessment made after the gate is closed shall be based on the order last running.

(9) If a water user feels that an assessment or penalty has been applied in error, he should immediately contact the Division Superintendent to specify his reasons. A water user may appeal an assessment or penalty within 30 days by notifying the District in writing of the disputed tailwater assessment. The Chairman of the Water Conservation Advisory Board shall appoint three members of the Board to serve as a committee to hear the appeal. The decision of the Tailwater Assessment Appeal Committee shall be final.

(10) Changes can be made for the last day of a run by notifying the District not later than 3:00 p.m. of the preceding day.

(11) When a water user requests an adjustment in the quantity of water delivered, not to exceed 2 cfs, the District shall be obliged to honor the same if it is within the ability of the District's system to accommodate such a request, and if the water user notifies the zanjero in advance of beginning his daily run. The zanjero of said run shall obtain approval to make said change from his respective superior or section.

(12) An adjustment in the water order may be made to apply to the last 12 hours of the water run, provided that the District is notified in advance, but not later than 3:00 p.m. preceding the time the order is changed. The District may honor changes until 4:00 p.m. if it does not disrupt service to other water users. No penalty shall be charged for a reduction as long as the same does not exceed 50 percent or 5 feet of the order as confirmed, whichever is less. Water that is returned with notice after 3:00 p.m. or that exceeds the quantity that this rule authorizes may be subject to an assessment equal to two times the regular water rate. This is in addition to the regular charge of the total order.

(13) Finish heads can be ordered up to 3:00 p.m. of the day preceding the day of delivery.

(14) Routine canal cutouts shall be accomplished no more frequently than once every 8 weeks, except when special circumstances require more frequent cutouts.

(15) Water may be delivered, off-schedule when and wherever possible, if it does not interfere with service to other water users.

THIS WILL CANCEL AND SUPERSEDE THE 13- AND 21-POINT PROGRAMS.

NOW, THEREFORE, on motion of Director Fornt, seconded by Director Gallegos, BE IT HEREBY RESOLVED, that the Rules Concerning Tailwater Assessments and Delivery Adjustments to Conserve Water as stated in Exhibit A attached hereto and made a part hereof, be adopted to become effective July 1, 1987.

BE IT FURTHER RESOLVED that this action will cancel and supersede the 13- and 21-Point Water Conservation Programs.

PASSED AND ADOPTED this 23rd day of June, 1987.

IMPERIAL IRRIGATION DISTRICT

By _____
President

By _____
Secretary

IMPERIAL IRRIGATION DISTRICT
ORGANIZED
JULY 25, 1911
EL CENTRO, CALIFORNIA

Copies:
Shreves
Wheeler
Fontaine
General Files

EXHIBIT 6-4

IMPERIAL IRRIGATION DISTRICT
WATER CONTROL SECTION
TAILWATER MONITORING SUMMARY
1987

MONTH	HEADS RUNNING TOTAL	HEADS RUNNING CHECKED	%	HEADS WITH OVER 15% TAILWATER DISCHARGE: FIRST CHECK HEADS	FIRST CHECK %	ASSESSED HEADS	ASSESSED %
JAN.	8159	7592	93.1%	198	2.6%	70	0.9%
FEB.	9251	8643	93.4%	228	2.6%	89	1.0%
MAR.	13286	12483	94.0%	243	1.9%	66	0.5%
APR.	16173	14824	91.7%	229	1.5%	53	0.4%
MAY	14650	13651	93.2%	178	1.3%	53	0.4%
JUN.	12586	11683	92.8%	88	0.8%	9	0.1%
JUL.	14125	13116	92.9%	116	0.9%	21	0.2%
AUG.	13999	12910	92.2%	164	1.3%	36	0.3%
SEP.	13901	12538	90.2%	196	1.6%	66	0.5%
OCT.	12226	10571	86.5%	153	1.4%	46	0.4%
NOV.	7209	6476	89.8%	74	1.1%	14	0.2%
DEC.	7536	6750	89.6%	128	1.9%	33	0.5%
TOTAL	143101	131237	91.7%	1995	1.5%	556	0.4%

TABLE 2

3.3 Regulating Reservoirs

The Trifolium Extension Canal Reservoir, presently under construction, is strategically located near the terminus of the Westside Main Canal (WSM). It is estimated that 4,100 AF of direct operational discharge will be conserved annually. Another 500 AF will be conserved upstream and downstream of the facility by allowing operational flexibility. The reservoir will be placed into operation by August or September of 1988.

IID forces will be constructing all control structures. These include:

- Inlet siphon
- Diversion siphon
- Safety outlet
- Outlet pump structure
- Various measuring structures

Dike construction is being contracted. As part of the overall system improvement at this location, both the WSM and the Trifolium Extension Canals have been lined upstream and downstream of the reservoir. Automation of the reservoir's various components is being developed with the help of an engineering consultant. A microprocessor at the site will monitor and manage all flow control structures. Communication will be maintained with Water Control personnel, where supervisory control will be integrated to daily operations.

"Z" Reservoir is the next reservoir planned for construction.

It will be located adjacent to the East Highline Canal (EHL) at the "Z" Lateral Heading.

Both the civil structures and automation system will be very similar to the Trifolium Reservoir design.

3.4 System Automation

IID staff is presently working with a consultant, UMA Engineering, to develop the automation facilities for the Trifolium Extension Reservoir. This will be used as a pilot project for planning automation for other key control facilities throughout the IID. A detailed description can be found in two reports submitted by UMA:

1) Trifolium Extension Reservoir Project Preliminary Automation Design Report.

2) Interim Report - Trifolium Extension Reservoir and Related Projects.

The approach to the SCADA system is to decentralize absolute control. Intelligent field units are installed at the site to be automated. The unit is programmed to monitor and manage all of the equipment at the site; for example radial gates, flow measuring devices, pumps, etc. Radio communication is maintained with Water Control continuously. Supervisory control is kept by Water Control personnel. The Water Dispatcher can set flows on order, transmit this information to the remote unit, and have gate adjustments made automatically.

UMA Engineering has designed systems for four irrigation districts in Alberta, Canada. These systems have been operated successfully since 1981. UMA Engineering's distributed approach to open channel control has been found to be the one best suited for the IID as well.

3.5 Operational Discharge

Continuous monitoring of 29 randomly selected lateral sites was conducted during 1987. This is the same sample set that was developed and monitored during 1986. One lateral was removed for the 1987 Study because of physical problems with the outlet structure.

Ash Lateral 45
Ash Lateral 6
Daffodil Canal
Dogwood Lateral 10
EHL Lateral 10
EHL Lateral 14
Elder Canal
Elder Lateral 13
Eucalyptus Lateral 10
Holt Canal
Lateral "E"
Lateral "S"
Malva Lateral 1
Marigold Lateral
Moorhead Lateral
Moss Lateral
Niland Lateral 2
Oakley Lateral
Oasis Lateral
Pomelo Lateral
Redwood Lateral
Spruce Lateral 3
Stanley Lateral 1
Sumac Lateral 1
Trifolium Lateral 5
Trifolium Lateral 9
Vail Lateral 4
Wistaria Lateral 6A
Wormwood Canal

East Highline Canal, Central Main Canal, Westside Main Canal and four other submain canals are continuously monitored. For 1987, operational spill from laterals was 84,990 AF and 9,157 AF from main canals. Total operational spill was therefore 94,147 AF. 96,110 AF was estimated for 1986. Statistical analysis indicates that data from these 29 sites may be used to extrapolate total system spill with a confidence level in excess of 95 percent.

3.6 Tile Drain Discharge

As discussed in the 1986 Water Conservation Activities Report a re-evaluation of the Tile Drain Discharge Program is being conducted by the IID. A special test area has been monitored for comparative purposes. Almost two years of sample data have been analyzed to determine the accuracy of the original program. Preliminary analysis indicates that tile drainage flows from the ten-field-test area is approximately 6 percent of delivered water. Data from the original sampling area indicates that tile drain discharge is 16 percent of delivered water. This discrepancy will result in a modified sampling network that will be more representative of actual flows.

3.7 Seepage Recovery

East Highline Canal seepage recovery continued during 1987. This program is very cost effective. Table 3 summaries data from 1970 to 1987. A total of 16,067 AF was recovered by 12 wells operated and maintained by the IID. Power costs average $1.84/AF recovered. This program is extremely beneficial to adjacent farms because of the predominently silty constituency of the soil in the area and its high seepage rate; a complete cost/benefit study has not been made.

Seepage recovery along the All-American Canal conserved approximately 8,000 AF of water. This is an estimate from studies conducted by Parsons Water Resources Incorporated.

WATER RECOVERY DRAINS PARALLEL TO EAST HIGHLINE CANAL

Year	DP-17 Plum to Pine		DP-18 Pear to EHL Lat. 10		DP-19 EHL Lat. 10 to Lat. 11		DP-20 Oat to Oasis		DP-21 Highway 80 to EHL Lat. 8		DP-22 EHL Lat. 8 to Pear		DP-23 Oak to Moss	
	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost
1970	1,321	479	1,416	533	658	332	653	314	1,088	447	621	328	925	361
1971	1,349	487	1,455	544	570	304	640	309	1,053	436	593	317	1,351	533
1972	1,207	451	1,388	526	568	306	599	295	1,123	456	652	332	1,297	519
1973	1,130	432	1,410	531	511	284	589	287	936	431	658	334	1,272	513
1974	1,109	590	1,363	680	599	384	587	304	889	532	588	385	1,340	700
1975	1,072	790	1,220	889	512	448	301	263	932	606	499	437	1,190	927
1976	984	755	1,084	839	470	422	371	314	865	717	507	461	1,269	948
1977	1,060	928	663	643	397	428	397	384	885	878	347	371	1,347	1,119
1978	977	977	559	679	390	462	441	439	911	915	242	438	1,298	1,272
1979	1,113	1,252	693	841	260	406	515	528	921	1,104	243	524	1,298	1,510
1980	922	1,245	676	992	194	339	475	630	778	1,102	281	580	1,313	1,796
1981	948	1,335	788	1,195	390	367	309	780	866	1,350	643	822	1,334	1,774
1982	1,089	1,913	811	1,648	377	435	258	1,125	860	1,796	482	997	1,240	2,198
1983	1,154	2,221	938	2,157	355	598	206	1,204	860	2,066	494	1,351	1,150	2,482
1984	1,066	2,206	842	2,087	288	591	249	1,224	902	2,036	456	1,268	1,215	2,535
1985	905	1,562	875	1,793	300	761	338	975	722	1,403	459	1,040	1,105	1,917
1986	889	1,829	833	1,878	512	827	339	1,111	701	1,536	476	1,266	1,095	2,153
1987	887	1,871	1,072	2,084	341	842	457	1,076	746	1,766	596	1,271	1,197	2,140

Year	DP-24 Ohmar to Oleander		DP-25 Orange to Ohmar		DP-26 Oxalis to Orange		DP-27 EHL Lat. 11 to Lat. 12		DP-28 Oasis to Orient		Totals		Average Power Cost Per Acre-Foot
	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	Acre-Feet Recovered	Cost	
1970	-	-	-	-	-	-	-	-	-	-	6,682	2,794	0.42
1971	406	143	-	-	-	-	-	-	-	-	7,417	3,073	0.41
1972	1,854	653	1,361	627	-	-	-	-	-	-	10,049	4,165	0.41
1973	1,795	636	1,489	648	3,309	1,120	2,731	1,012	-	-	15,830	6,228	0.39
1976	1,388	1,168	1,370	1,195	3,126	2,387	3,062	2,271	3,296	2,092	17,792	13,569	0.76
1977	1,760	1,388	1,210	1,388	3,047	2,665	2,947	2,566	3,244	2,412	17,304	15,170	0.88
1978	1,833	1,569	1,322	1,544	3,704	3,475	3,039	2,863	3,255	2,633	17,971	17,266	0.96
1979	1,639	1,827	1,146	1,780	3,332	3,777	3,014	2,469	3,449	3,383	17,623	20,401	1.16
1980	1,625	2,138	1,113	2,061	3,357	4,469	2,883	3,836	3,499	3,983	17,116	23,171	1.35
1981	1,456	1,915	1,249	2,139	3,235	4,339	3,021	4,040	3,321	3,923	17,560	23,979	1.37
1982	1,523	2,346	1,188	2,741	3,460	5,966	2,947	5,213	3,148	4,956	17,383	31,334	1.80
1983	1,478	2,666	1,287	3,137	3,373	6,788	2,794	5,691	3,052	5,928	17,142	36,289	2.12
1984	1,440	2,690	1,120	3,092	3,280	5,539	3,280	5,539	2,669	5,807	16,807	34,614	2.06
1985	1,604	2,237	1,008	2,480	1,870	3,219	2,544	4,087	2,991	4,565	14,721	26,039	1.77
1986	1,586	2,937	1,081	2,919	1,977	5,324	2,692	4,703	2,891	4,857	15,072	31,340	2.08
1987	1,576	2,831	1,295	2,707	2,720	5,656	1,866	2,848	3,314	4,521	16,067	29,613	1.84

TABLE 3

Mileage: .50 Mile - Total 6.00 Miles
Power costs calculated in Engineering Section

3.8 Hydrilla Control Research Program

The noxious weed Hydrilla, if left unchecked, will clog and restrict water flow causing flooding and difficulty in managing the water which will result in additional operational losses. As described in the 1986 Water Conservation Report, the Hydrilla Control Research Program is being carried out as a multiagency cooperative effort to:

1) Identify and evaluate eradication methods,

2) Coordinate research efforts in Imperial Valley,

3) Design, develop and implement eradication technology.

During 1987 an eradication program founded on work conducted since 1981 was developed. Having identified biological control as the best method available, the IID developed plans for constructing a Triploid Grass Carp production facility. Descriptions of activities were summarized by the Hydrilla Technical Advisory Committee in their quarterly reports.

Plans were prepared to include:

1) An administration office,

2) Testing laboratory,

3) Breeding laboratory,

4) Hatchling and holding ponds.

Construction of the facility began in mid 1987 and continued

for several months while the design of the laboratory/office facility was finalized. Full operation of the Grass Carp Production facility is schedule to commence during the first quarter of 1988.

3.9 Demonstration Tailwater Recovery Program

Demonstration tailwater recovery systems - also designated "pumpbacks" - were installed on the following five fields during 1985 and continue to be monitored:

Newside Lateral 3-A, Gate 30A & 33
Central Main, Gate 15 & 16
"Q" Lateral, Gate 13 & 15
Trifolium Lateral 8, Gate 153
Ash Lateral 25, Gate 61E

The capital and maintenance costs of these systems are paid by the District from the Water Conservation Fund, except the energy charge component of the power bill, which the water user pays.

Table 4 is a cost summary of the five systems installed. The major physical data is given in Table 5.

The purpose of this program is to determine the effectiveness, potential problems and associated costs of tailwater recovery systems on different soils, slopes, crops, etc. Delivery, tailwater, recycled tailwater, water salinity, soil salinity, and temperature are being monitored.

TAILWATER PUMPBACK SYSTEMS
COST SUMMARY

LOCATION	PUMP		PIPELINE		POND		TOTAL
	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR	
ASH 61E	16,679	1,318	39,635	7,642	2,786	2,786	70,998
CENTRAL MAIN 15 & 16	9,858	2,303	49,115	16,276	2,786	1,858	79,950
NEWSIDE 30-A & 33	11,116	3,655	29,615	12,663	2,243	8,906	68,198
Q-15 & Q-13	8,617	4,116	40,611	12,911	2,485	4,919	72,583
TRIFOLIUM 8 - 153	21,881	2,149	35,231	10,359	2,843	2,741	75,204

TABLE 4

TABLE 5

TAILWATER PUMPBACK SYSTEMS
SUMMARY

SYSTEM OWNER	COST ($)	AREA SERVED (AC)	SERVICE LINE		PUMP		STORAGE VOLUME (AF)
			SIZE (PVC)	LENGTH (FT)	HP	CAPACITY (CFS)	
VEYSEY	68,198	320	12"	3,425	20	3	4.0
BENSON	79,950	440	12"	6,700	30	3	10.0
SMITH	72,583	175	12"	5,450	30	3	3.0
MALLORY	75,204	188	12"	5,200	20	3	3.7
NILSON	70,998	155	12"	5,100	20	3	2.8

The tailwater recovery systems were designed to capture irrigation water that runs off the low end of the field, store it for a short period of time (hours), and then reapply it to the same field or one nearby.

Tailwater salinity appears to be directly related to the salinity of the soil in the field. As water travels across the field it picks up salts from the soil. In addition, during the summer the salt in the water is concentrated by evaporation as water travels across the field. In general, if the field has a low soil salinity, tailwater from that field will also be low in salinity. If the field has a high salinity, the salinity of the tailwater from the field will be high. Tailwater temperatures on alfalfa fields have been measured as high as 110°F during the summer. Irrigation efficiency ranged from 87 percent to 99 percent.

Table 6 is a summary of the irrigations monitored during 1987.

TABLE 6

DEMONSTRATION TAILWATER RECOVERY SYSTEM

Efficiency Summary
November 1986 - December 1987

LOCATION	DELIVERY Ac-Ft.	TAILWATER Ac-Ft.	RECYCLED Ac-Ft.	RECYCLED PERCENT	IRRIGATION EFFICIENCY PERCENT*
Ash 61-E	686.0	70.2	64.6	9.4	90
Central Main 15 & 16	1090.2	133.5	352.5	32.3	87
Newside 30-A & 33	1452.0	14.5	195.6	13.5	99
"Q" Lat. 13 & 15	957.2	90.6	98.6	10.3	91
Trifolium 8 - 153	685.8	8.8	44.0	6.4	99

* Weighted average - irrigations when tailwater could not be determined are not included in Irrigation Efficiency calculations.

Table 7 contains some selected measurements that were taken during the summer on alfalfa and cotton. The data indicates that although tailwater temperatures are higher during the day, they are substantially lower at night. If properly managed it may be possible to prevent increased scalding when pumping back water.

Table 8 is a summary of the 360 water samples collected and analyzed for salinity.

Increases in the salinity of the tailwater range from 13 percent to 80 percent. When the tailwater is pumped back and mixed with the lower salinity delivery water the overall increase in the salinity of the water applied to the fields ranges from 3 percent to 30 percent.

Over 2,000 soil samples were initially collected from the fields involved in the demonstration pumpback program. After one year additional samples were collected from one of the systems. Analysis of the data from Newside 33 indicate that the soil salinity increased slightly during the first year. Additional samples are presently being collected from all of the fields after two years. It may be necessary to do additional leaching to maintain the salinity balance in the field.

DEMONSTRATION TAILWATER RETURN SYSTEM
SELECTED TEMPERATURES
12-16-86

LOCATION	DATE	TIME	SAMPLE	TEMPERATURE DEGREES F
ASH 61E	06-18-86	12:40	DELIVERY	84
	ALFALFA		TAILWATER	95
			POND	84
			PUMP	82
			AIR	102
	05-02-86	13:10	DELIVERY	80
	ALFALFA		TAILWATER	84
			POND	78
			AIR	88
Q-15	07-30-86	10:10	DELIVERY	84
	ALFALFA		TAILWATER	88
			POND	80
			AIR	90
TRIFOLIUM 8-153	06-23-86	09:15	DELIVERY	80
	COTTON		TAILWATER	80
			POND	76

TABLE 7

DEMONSTRATION TAILWATER RETURN SYSTEM
SALINITY SUMMARY
12-16-86

LOCATION	SAMPLE	AVERAGE E.C.
ASH 61E	DELIVERY	0.96
	POND	1.09
	MIXED	0.99
CENTRAL MAIN 15 & 16	DELIVERY	0.89
	POND	1.33
	MIXED	1.07
NEWSIDE 30A & 33	DELIVERY	0.90
	POND	1.62
	MIXED	1.17
Q 13 & 15	DELIVERY	0.89
	POND	1.21
	MIXED	1.05
TRIFOLIUM 8-153	DELIVERY	0.87
	POND	0.97
	MIXED	0.85

TABLE 8

3.10 Irrigation Scheduling Program

Thirty-three growers cooperated in the Irrigation Scheduling Program on 12,852 acres. The tabulation below lists the total acreage by crop scheduled during 1987. Twelve growers were added and eight were dropped from the program during the year. All of the scheduling was done using water budget by computer modeling, based on CIMIS (refer to Section 3.11) weather data. Neutron probes were used to field check the computer generated soil moisture predictions. The average irrigation efficiency of the 1,199 irrigations monitored was 85 percent. Table 9 is a summary of the 7,474 irrigations monitored in the program since 1982.

IRRIGATION SCHEDULING PROGRAM

	Acres
Alfalfa	4,960
Row Alfalfa	822
Bermuda Grass	1,251
Broccoli	182
Carrots	152
Cotton	584
Lettuce	37
Melons	150
Oats	35
Onions	145
Sudan	337
Sugar Beets	2,758
Wheat	1,439
TOTAL ACRES	12,852

Total Neutron Probe Sites	197
Sites added this year	156
Sites removed	106
New Growers to program	13
Growers Dropped from program	8

IRRIGATION SCHEDULING PROGRAM
Summary

	1982		1983		1984		1985		1986	
	Applied Water Ac.-In.	Irr. Eff. (%)	Applied Water Ac.-In.	Applied Water Ac.-In.	Irr. Eff. (%)	Applied Water Ac.-In.	Applied Water Ac.-In.	Irr. Eff. (%)	Applied Water Ac.-In.	Irr. Eff. (%)
Alfalfa	77	88	68	88	66	87	69	86	74	87
Row Alfalfa	-	-	-	-	-	-	72	82	67	80
Cotton	60	84	64	83	54	83	57	82	63	80
Wheat	*	89	25	88	34	87	30	86	32	88
Sugar Beets	*	76	50	78	56	76	43	80	49	80
Bermuda	-	-	-	-	*	90	48	79	42	85
Onions	-	-	-	-	53	78	-	-	-	-

*Entire crop season not monitored

TABLE 9

3.11 CIMIS

A grant of $25,000 per year for three consecutive years beginning in June 1985 was received by the IID from DWR. Preliminary work has been completed in developing crop coefficients this year. CIMIS evapotranspiration (ET) data is now being used to model soil moisture depletion in the IID's Irrigation Scheduling Program. The ET data is supplied by the IID for daily publication in the local newspaper and for US Weather Service reports for use by local growers for more efficient irrigation scheduling.

4.0 SUMMARY

4.1 Diversions

A review of IID water diversions for calendar year 1987 and past years will help place the water conservation program into perspective. The IID's goal is to conserve thousands of acre-feet by improving a system that delivers millions of acre-feet yearly; a system recognized by USBR as being one of the most efficient in the southwest. (Reference USBR, "Report on the Water Conservation Opportunities Studies," (September 1978).

IID diversions for 1987 totaled 2,758,681 AF as measured at Pilot Knob. Five programs implemented by the District have reduced distribution losses; these programs are tailwater monitoring, reservoir construction, seepage recovery, 15-Point Program, and operational spill monitoring. Quantifying the exact amounts of water conserved by each program is difficult. Problems include the vast number of points to be measured, the overlapping impacts, the difficulty in following ground water movement, etc. However, a comparison between historical District diversions and recent diversions can be made in order to fully appreciate the District's water conservation efforts.

Average annual diversions for 1960 to 1970 inclusive was 2,882,232 AF. For 1977 to 1987 inclusive, the average annual diversion was 2,711,297 AF. A comparison can be made between the difference of these historical averages, 170,935 AF, and the estimates

of water conserved during the later period. It should be noted that the cropped acreage has not varied significantly during either period.

Estimates of water conserved annually by various programs are as follows:

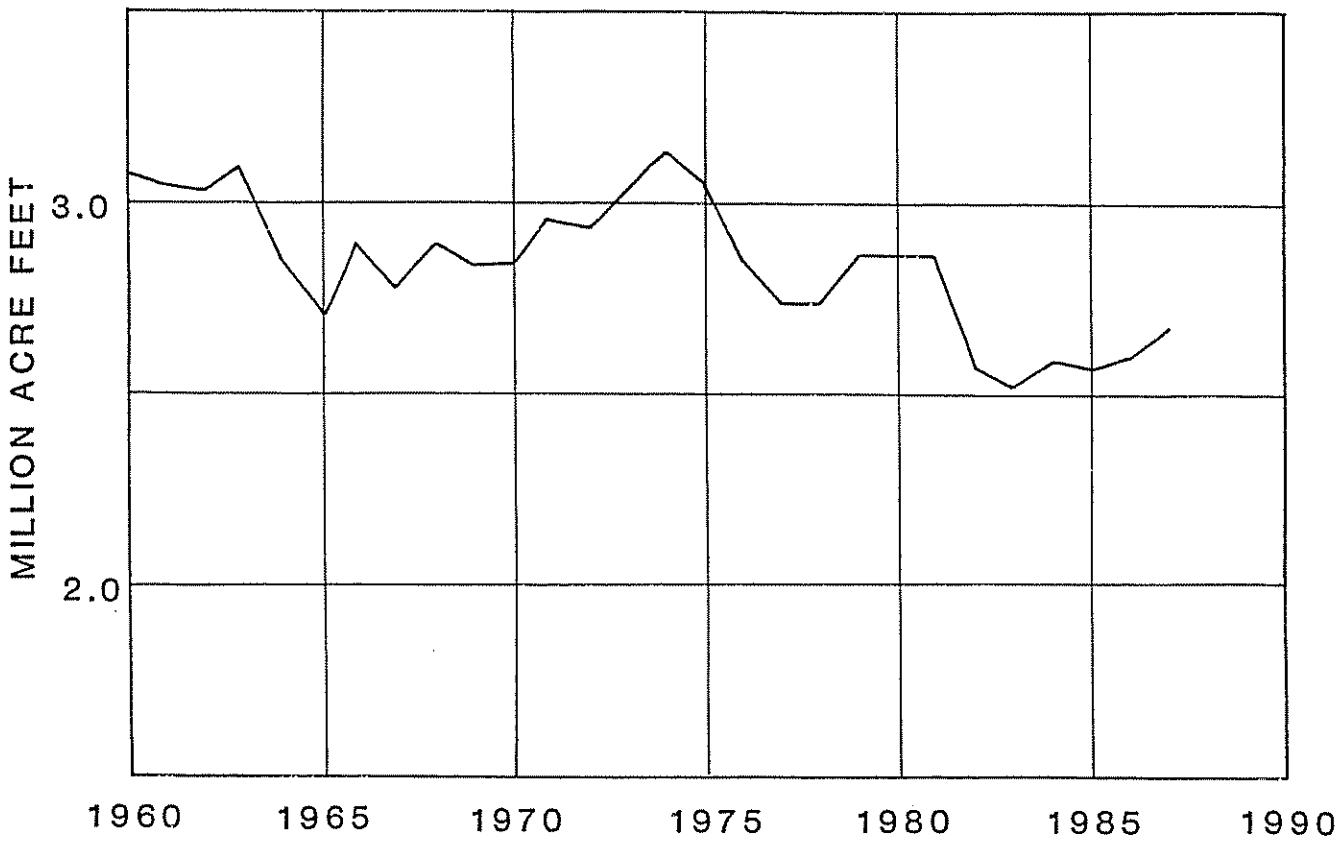
Concrete Lining	57,000 AF
Operational Discharge Reduction	26,000 AF
Seepage Recovery	25,000 AF
Tailwater Assessment	20,000 AF
	138,000[1/]

This is in the range of the noted decrease. The variables involved in determining annual water use are complex (cropping pattern, soil types, government subsidy programs, etc.), but the general down trend in IID diversions is significant. Please refer to Exhibit 7.

1/ Parsons, 1985

IMPERIAL IRRIGATION DISTRICT DIVERSIONS

HISTORIC USE



SOURCE:

COLORADO RIVER BOARD OF CALIFORNIA WATER REPORTS

EXHIBIT 7

4.2 Inflow To The Salton Sea

One of the best indicators of the success of the IID's Water Conservation Program, is the measurement of it's drainage inflow to the Salton Sea. Exhibit 8 lists the IID's portion of inflow to the Salton Sea for the past 17 years. In 1980 the IID substantially increased it's conservation efforts; the 21-Point Water Conservation Program was adopted and increased emphasis was placed on reducing operational discharge. The following year the IID's inflow to the Salton Sea dropped from 37.7 percent to 34.8 percent of water received. Inflow to the Salton Sea has continued to drop, in 1987 it was 32.0 percent a reduction of 5.7 percent (189,000 AF) from 1980. This also follows from the discussion in Section 4.1 concerning the general down trend in water diversions during the last 27 years.

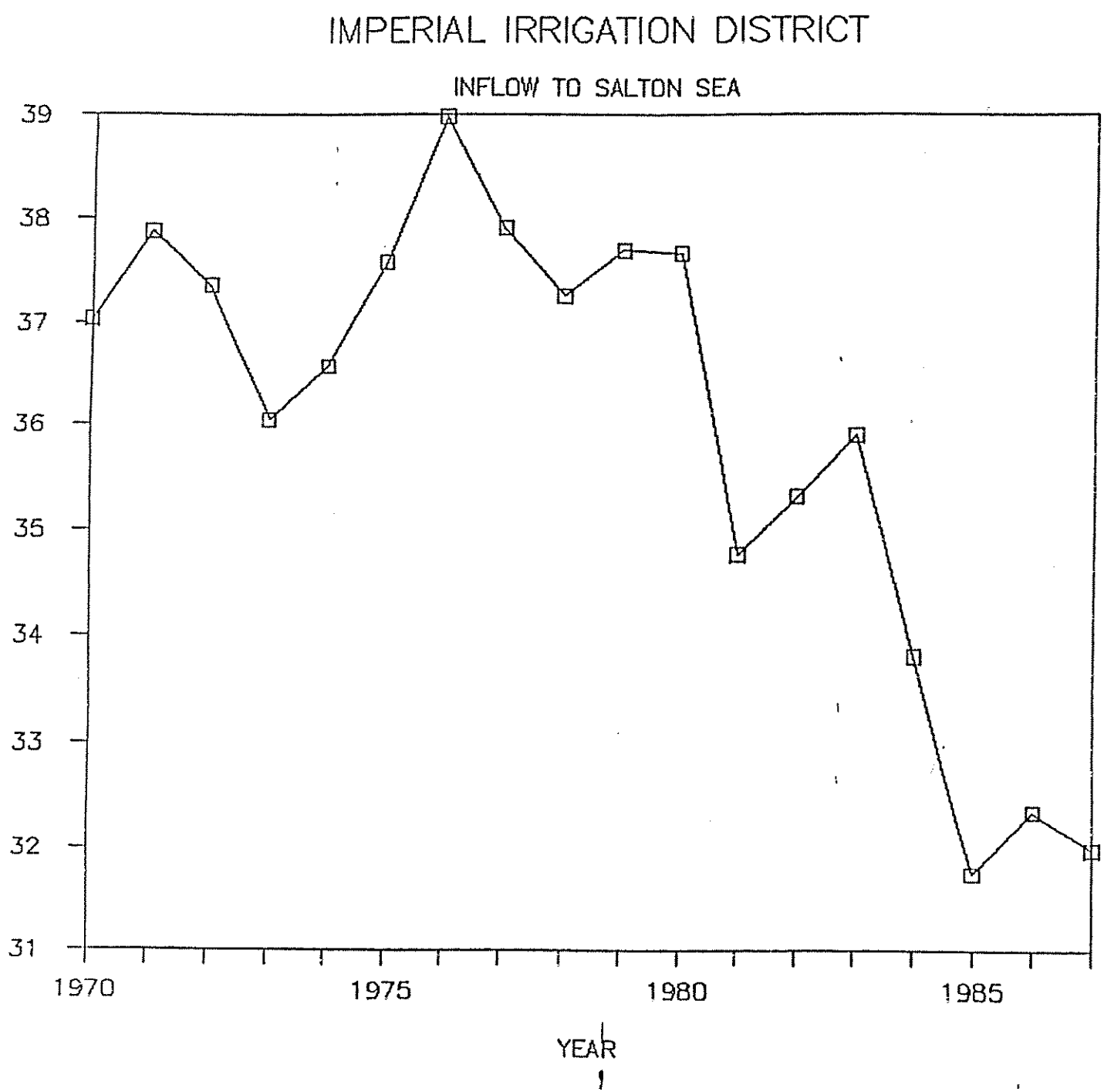

IMPERIAL IRRIGATION DISTRICT
INFLOW TO SALTON SEA
PERCENT OF DROP #1
39
38
37
36
35
34
33
32
31
1970
1975
1980
1985
YEAR

EXHIBIT 8